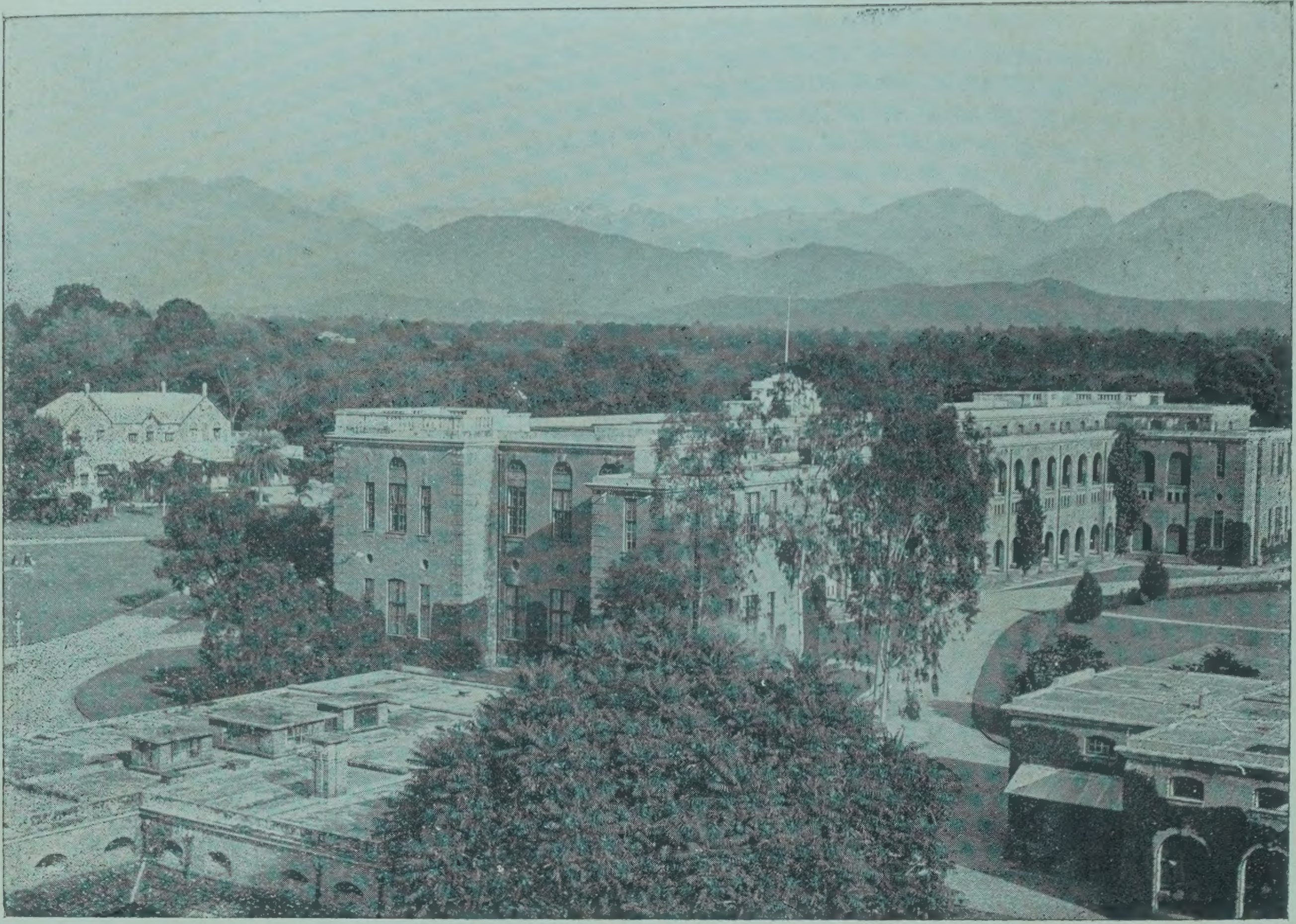
XLIX



General view of the present Forest Research Institute.

Photos. by R. P. Dalley, I.F.S.

An approach view of the new Forest Research Institute.

1679

VOLUME XLIX NUMBER 5

INDIAN FORESTER

MAY 1923.

A VISIT TO THE FOREST RESEARCH INSTITUTE, DEHRA DUN.

PART I.

Introduction.—The following note has been written by a Forest Officer visiting Dehra Dun for the first time, and records impressions of what he saw and heard, in connection with the Forest Research Institute, during the first few weeks of his visit. In view of the necessity for retrenchment, and the doubt which exists as to the Sanctioned Scheme of Development being allowed to go through, an attempt has been made below to discuss the matter in popular style, and to set forward the arguments in favour of development from the point of view of a Forest Officer, who has never before had anything to do with research work, but who is now beginning to realise something of its value.

First impressions of a Newcomer.—To a newcomer the scheme of development in connection with the Imperial Forest Research

Institute at Dehra Dun is somewhat awe-inspiring. One sees here one's dreams of Forest Development, not only taking shape, but doing so on a scale far grander than that of which one had ever dreamt. In fact one almost feels, in these days of axes, that there must be something wrong when the President of the Institute shows one over "The New Site," and says that the spacious buildings, which are now being fitted with all kinds of expensive machinery, are only the workshops of the Economic Branch. No residential quarters have yet been started nor has anything been done in connection with the erection of the Main Building, which will contain the offices of the President and the Heads of Research Branches and the Museums. This building alone is planned to be twelve hundred feet long. As a matter of fact the Inchcape "Axe" *has* cast its shadow before it, for no new construction is being permitted for the present, though the whole scheme, estimated to cost some fifty lakhs, has long ago received the sanction of the Secretary of State.

A comparison of the areas of The New Site (about 1,300 acres), and of the present Institute (about 26 acres) is enough to take a newcomer's breath away; especially when he is told that the present Institute is still quite a baby, about eight years old. It is just this very fact, however, that forms the main argument in favour of taking up such a large area. The present Institute is already badly overcrowded. Four different schemes for extending the present site have been considered but the most that any of them would yield was another 26 acres. As the Economic Branch alone required at least 72 acres for its sanctioned Workshops and Mills, the question of extending the present site had to be dropped. The President was determined that the mistake of selecting too small an area should not be repeated. In his opinion, if anyone has the duty of selecting a site for a new scheme or business, he should first calculate the amount of space required, then add to it the space he thinks will be required for future expansion, and then multiply that result by three at the very least.

Value of a Visit to Dehra Dun.—Another thing that impresses a newcomer very forcibly is that, the best answer to

the natural question "why should so much money be spent on developing the Forest Research Institute?" is, "visit Dehra Dun and see for yourself!" Even a newcomer can see that the necessity is great. A visit to Dehra Dun reveals the congested state of the present Institute, and the difficulty of extending the present site. The visit does more, it somehow impresses the visitor, far better than any description could do, with the practical value of the work that the Research officers are carrying out. These officers are very keen to show Forest Officers, and others interested in forest matters, round both the present Institute and the New Site. They believe that every Forest Officer should visit Dehra Dun. Such visits not only have a valuable educative effect, but help forward Research work, both in the Forest and at the Institute, because of the better understanding and co-operation which result from them.

The present Research Institute.—Before passing on to the description of the New Site, a few remarks about the present Institute are necessary. It is situated in Dehra Dun Cantonment in pleasant park-like grounds, at a distance of about a mile from the Rangers' College and the President's residence, which is known as "Forest Park." The Provincial Classes, however, have their quarters and lecture rooms, and their football and hockey ground in the grounds of the Research Institute. The present Rangers' College served as Research Institute and College combined, as recently as eight years ago. It is now too small as a Rangers' College.

Organisation.—The President is the controlling officer both for Forest Research and for Forest Education. The Research work is divided into five branches, controlled respectively by the following officers:—

The Forest Botanist,
The Forest Economist,
The Forest Chemist,
The Silviculturist, and
The Forest Entomologist.

Each of these officers is assisted by one or more Imperia or Provincial service officers.

The Economic Branch is further sub-divided into the following Sections:—

Minor Forest Products,
Timber Testing,
Timber Seasoning,
Wood Technology, and
Paper Pulp.

The section of Minor Forest Products is in charge of an Imperial Service Forest Officer. The remaining Sections are run by specialists engaged on short term contracts. Their staffs are also engaged on a temporary basis at present. There is, in addition to these Sections, a Wood Workshop in charge of a Superintendent, engaged in England, who is assisted by a European Carpenter, also recruited from home. At the New Site provision has been made for two more Sections, *viz.*, Timber Preservation and Veneering; there will be an iron workshop in addition.

Buildings.—There are only three residential buildings at the present Institute. One is occupied by the Forest Botanist, one by the House Tutor in charge of the Provincial students, and one is reserved as a chummery for bachelors and "grass-widowers."

The Main Building is double storeyed. On the top floor the Silviculturist and Forest Entomologist have their offices and museums. The officer in charge of the Paper Pulp Section also has his office upstairs. On the lower floor there are the Timber and the Minor Forest Products Museums, the Library and offices for the Forest Economist and his staff.

The Forest Botanist's office, the Herbarium and the Photographer's Dark-rooms and Studio are situated in a separate building to the north of the Main Building.

To the south-east of the Main Building are three small buildings—the Insectary (where forest insect pests are reared), the Forest Entomologist's laboratory and a Students' Laboratory.

To the south-west of the Main Building is an irregular line of buildings. First comes a small Timber Testing Labora-

tory; then a larger building, the Forest Chemist's Laboratory and office, then a small Gas Factory, and then the Distillation Plant. Last of all two small sheds, one of which is the Wood Workshop, and the other the European Carpenter's Workshop. At the farther end of the Wood Workshop a temporary kiln has been erected for demonstration purposes, which will be dismantled shortly, after a test run of *Dalbergia Sissoo* planks and felloes from Jubbulpore has been carried out. The Paper Pulp Specialist has a small Laboratory in the same building as the Forest Chemist.

The officers of the Economist's Branch are extremely badly off for room. Although the Timber Testing Officer has only four Testing Machines in his Laboratory there is literally no room in it to move. The Seasoning Specialist has to borrow odd corners from other officers for carrying out his laboratory experiments. The Paper Pulp Specialist has none too much room but has to put up with the Seasoning Officer's Laboratory Kiln. The Wood Workshop is ridiculously overcrowded. Apart from the lack of space for storing lumber, there is barely room in it for the various machines, and the carpenters are practically sitting on top of each other. This Shop contains one small Circular Saw-Bench, one Small Band-Saw, a Planing Machine, a Vertical Spindle Moulder, two Drilling Machines and a Saw-sharpening Machine.

NECESSITY FOR THE NEW SITE SCHEME.

The Need for Expansion.—In view of what has been said above it is clear that the needs of the Economic Branch alone necessitated the selection of a new site for the Research Institute as there was no possibility of extending the present one. The fact that Forest Research on a scale approaching commercial conditions is about to be undertaken, means that the Economic Branch will alone occupy an area about three times the size of the present Institute. And, as the remaining Branches of Research had reached the limit of expansion possible in their present buildings, and could do with a good deal of additional space, it was decided that the whole Institute should move to

a fresh site. The question of moving the Institute to some more convenient and central station, such as Jubbulpore, was considered, but the advantages which Dehra Dun offered in the way of climatic considerations and the fact that the Institute was already there, and could easily be visited by commercial people journeying to and from Mussoorie, led to the retention of the Institute at Dehra Dun. As the New Site Scheme, involving the transfer of the whole Institute and the Provincial Classes, to a site two miles further out from Dehra Dun, was sanctioned at a time of prosperity, when exchange was high and money was easy to obtain, the question as to whether the expenditure which the complete move entailed was justifiable or not was barely given the consideration which it is now receiving. The opinion is now frequently expressed that only the Economic Branch of the Research Institute should move to the New Site, and that the remaining branches and the museums should remain where they are till the financial situation improves. The necessity for the complete move will naturally increase as time goes by. There are, however, two other aspects of the New Site Scheme which may be urged in favour of an early move of the whole Institute to its new home. These are the questions of Residential quarters and of Forest Education.

Residential Quarters.—Research Officers and Instructors experience, at present, considerable difficulty in the matter of obtaining convenient bungalow accommodation. The present Institute only has three bungalows attached to it. Most officers have to live miles away from their work, either in expensive bungalows or in hotels. The New Site provides thirty-four bungalows for the President and controlling staff, and quarters for all others who will be connected with the future Institute. The benefits to be derived from such a concentration of bungalows and quarters may be appreciated without any special mention.

Forest Education.—The question of Forest Education is, at present, very much in the melting pot. It is very likely that Rangers' College will be completely provincialised. If this happens it is proposed that the present Rangers' College should be sold, as the land is extremely valuable, and that the present

Research Institute should be handed over to the Government of the United Provinces as their Rangers' College. The Provincial Classes will move with the Institute to the New Site. The action of the Legislative Council, in deciding that even the Imperial Forest recruits should receive their training at Dehra Dun, even though such a course will be much more expensive than the present arrangement of training them in Europe, is, in itself, a justification in part for the New Site Scheme, which has allowed ample room for unforeseen expansion of this kind.

Description of the New Site.—The site is three miles long and, on an average, three quarters of a mile wide. It runs practically East and West, being bounded on the South by the Chakrata Road, and on the North by a wide and deep nulla which runs down from the heights of Mussoorie towering above to the North-East. The site is situated in beautiful open country with fields all around. The highest ground on the site is within a few feet of the nulla referred to above, and forms a long ridge immediately overlooking it. The slope of the ground is precipitous towards the nulla, but very gentle in the direction of the Chakrata Road On this ridge, it is hoped, will be built the bungalows for Research Officers and Instructors. The view from here is perfectly wonderful. Mussoorie seems only a step. The Chakrata Hills, some distance away to the North, are particularly picturesque, and the rugged Siwaliks, circling the Dun towards the South and West, complete the picture. This must be one of the finest building sites in India : one cannot help congratulating the officers who were responsible for its selection.

The Main Building will be three and a half times as long as the present Main Building, and will also be on the ridge, but set forward a little from the line of bungalows. The Workshops, Kilns, Mills and Godowns, of the Economic Branch, which are the only buildings which have so far been built, lie in the Eastern corner of the New Site, a little to the East of the site for the Main Building. The bungalows for the officers of the Economic Branch will occupy the Eastern end of the ridge, not far from the scene of their work. Quarters for the subordinate staff and for labour will be lower down, nearer the Chakrata Road. The Main

Entrance will be from the Chakrata Road, by a fine wide avenue leading straight up to the Main Building. The approach to the Economic Branch lies through a tea garden, the shelter trees of which (chiefly *Albizzia procera*) are so closely grown that the road looks like a delightful forest avenue. By this road the eastern end of the New Site is not quite two miles from the present Institute. The following is a description of the buildings of the Economic Branch which have been actually built.

THE ECONOMIC BRANCH.

Grouping of the Sections.—The Sections of the Economic Branch have been grouped in three Units, as follows:—

Unit I.—Sawmill.
Iron Workshop.

Unit II.—Seasoning.
Pulp and Paper.
Preservation.

Unit III.—Wood Workshop.
Veneer Mill.
Timber Testing.
Minor Forest Products.

In addition to the buildings connected with the above Sections, the only other buildings which have been built are an Electric Transforming Station and Quarters for a Store-keeper.

Layout.—The three Units are side by side, Unit I lying in the eastern corner of the site, Unit II next to it, and Unit III nearest the Main Building. Unit I consists of two blocks of buildings only—the Sawmill and the Iron Workshop. Unit II consists of four blocks—an office building for the Sectional Officers and their staffs, the Seasoning Plant, the Paper Mill and Preservation Plant with the Boiler Room and, finally, a large Godown. Unit III consists of three blocks—an office building like that of Unit II, one large block containing all four sections and a large godown similar to that of Unit II. The three sections of Unit II will require steam in addition to electric power. The other

Units will be run by electric power only, except that the Veneer Mill will have a small boiler for steaming logs.

Communications.—The three units will be connected up by tram-lines for the movement of material. There will also be metalled roads connecting the various parts of the branch, some of which will be main thoroughfares. Hand controlled trucks will be used on the tram-lines.

To facilitate the handling of material indoors the Sawmill, the Paper Mill and all the Sections of Unit III will be fitted with gantry cranes. Some of these are already in position. No rails are provided inside the five kilns, as they will be loaded and unloaded by hand. The lumber has to be handled in any case when it comes from the Sawmill, for sorting and grading purposes, so that kiln trucks would have offered no particular advantage.

Constructions.—Mr. F. T. Jones of the P. W. D. is in charge of all construction work, but the erection and fitting of the machinery is being done by Mr. Low, very ably assisted by Mr. Ram Das, both of the P. W. D. The various Sectional Officers exercise technical supervision over the fitting work, which necessitates their visiting the New Site almost every day. Up to the present the Iron Workshop and one Tiemann Kiln have been completely fitted, and the Paper and Pulp Mill, the Preservation Plant, the the Veneer Mill, The Timber Testing Plant and the Sawmill Plant are all being put down. It is hoped that the plant of all sections will be completely installed by the end of next April.

The walls of all the buildings are of red brick, strengthened where necessary by reinforced concrete pillars. The roofs are all of corrugated iron, which is being covered with creosoted pine shingles. A more detailed description of the plant is given below.

PLANT.

The Machine Shop.—This is fitted in up-to-date fashion, and is now in actual working as the electric power, which should have been supplied in October, has recently been connected in by the Mussoorie Municipality. The machines include a drilling machine,

a lathe, a threading machine, various tool sharpening machines and a first-class shaping and surfacing machine. Attached is a blacksmith's forge.

The Samwill is fed by an electric gantry crane nearly three hundred feet long. A log pond will be constructed between the uprights of the gantry for most of its length, so that logs, on arrival at the Mill, will be immediately placed under water safe from climatic and insect dangers. These logs will not need further handling when their turn comes to enter the Sawmill, as they will be picked up out of the water by the gantry and placed on the top of a log roll. At the end of the log roll will be the log carrier for the breaking down saw, which will be of the circular type. The log will be carried backwards and forwards on the carrier till completely converted. The cut slab will pass on to the edger, where it will be cut to the required width in one operation, and will pass straight on to the cross cut saw (pendulum type) where it will be cut to the required length. Thus there will be in all only three benches. The material will pass through the Mill with the minimum amount of handling. From the Sawmill the lumber will pass, by tram-line, either to the Seasoning Kilns or to the Godown of Unit II.

The Pulp and Paper Mill.—This is an up-to-date plant, which will permit of various kinds of raw material being treated in different ways on a semi-commercial scale. The digesters and diffusers of the Pulp Mill have been erected, and impress one by their massive proportions. The whole plant of both parts of this Mill cost about £12,000.

The Preservation Plant.—This will be a Pressure Plant. There will be two storage tanks (for creosote and earth oil respectively), a mixing tank, an impregnation cylinder, capable of holding broad gauge sleepers, two pressure vessels and the necessary pressure and vacuum pumps. The mixture of the treating fluid, and the temperature and pressure inside the cylinder will be capable of variation at will. The plant is now being installed, under the technical supervision of the Forest Economist himself, as there is, at present, no Preservation Officer, though the appointment is one that has been sanctioned.

Offices of Seasoning, Preservation and Paper and Pulp Sections. Tiemann Seasoning Kilns Boiler House and Paper and Pulp Mill.

View of part of the Economic Branch, new Forest Research Institute—looking W.

Photos. by R. P. Dalley, I.F.S.

Boiler House and Paper and Pulp Mill. Godowns Corner of Sawmill

Continuation of the above view.

The Seasoning Kilns are all of the Compartment, and not of the Progressive type. There are three Tiemann Water Spray Kilns of American manufacture, and two Sturtevant Kilns of English make. The former is the kind chiefly used by the American Forest Service in their Research work, and has also been adapted for commercial work in connection with the seasoning of refractory timbers. The latter kind has been successfully used at the Royal Air Force Factory at Farnborough. The two kinds of kilns represent two different principles in kiln drying, both as regards the means of circulating the air and the method by which the humidity is controlled.

In the *Tiemann Kiln* the circulation of the air is brought about by differences of air-pressure on the 'entering' and 'leaving air' portions of the kiln. The difference in air-pressure is brought about by means of fine sprays of cold water, which shoot downwards from a line of spray nozzles into a narrow 'spray chamber' situated along one or both sides of the kiln. (In the kilns at the New Site, which are of a small and narrow type, there is only one spray chamber in each kiln. In commercial kilns, *e. g.*, the ones at the Wood Working Institute at Bareilly, there are two) These sprays, by cooling the air and carrying it downwards to the bottom of the spray chamber, cause the air above to sink, or be drawn down on the leaving air side of the pile, or stack of timber. The entering hot air rises up the other side of the 'pile,' and passes downwards through it owing to the action of the sprays and also to the cooling effect of the drying timber. The moisture absorbed by the air as it passes through the pile is condensed by the sprays. The air is recirculated through the pile after it leaves the bottom of the spray chamber. It naturally leaves the spray chamber in a saturated condition. By passing first through some wooden baffles the spray or mist is mostly removed. It then passes over the 'Heating Coil,' four coils containing from four to fourteen pipes passing the full length of the kiln, under the pile. These coils may be independently filled with either high or low pressure steam, according to the temperature required. As the saturated air passes over the heating coils it becomes heated, and therefore no longer remains saturated. The actual percentage of the relative

humidity of the 'entering air' can be very exactly controlled by varying the temperature of the water in the sprays. The warmer the water in the sprays, the warmer will the saturated air be, and the higher will the relative humidity of the heated air be after it passes through the heating coils into the kiln above. The amount of steam that passes into the heating coils can be regulated by means of a thermostat, so that the temperature of the entering air is kept constant automatically. The temperature of the water passing into the water-spray line can also be kept constant automatically by means of a 'Water Mixture,' which takes in both hot and cold water in just the right proportion, no matter how much their temperatures vary, so as always to give out water of the correct temperature for the sprays, with the result that the humidity of the entering air is also automatically controlled.

In the *Sturtevant Kiln* the heated air is forced through the timber pile by means of a fan or blower. In the type being fitted at the New Site the side walls of the kilns are hollow, and contain numerous vents. The fans blow air through radiators, containing heated steam coils. This heated air then passes into the hollow wall on one side of the kiln. Thence it passes into and through the timber pile, and is drawn out into the hollow wall on the other side through the vents. This exhaust air is sucked out of the hollow wall by the action of the fan, which recirculates it, thus causing economy in heating. If the recirculated air is too moist, fresh air is added to it before it passes over the radiators again. If there is not sufficient humidity in the entering air this is supplied by means of a live steam spray pipe placed inside the kiln. In this type of kiln the humidity cannot be controlled automatically, but has to be watched and controlled as required. The temperature of the entering air can be controlled automatically by means of a thermostat, which regulates the quantity of steam supplied to the radiators in such a way that the temperature of the air is maintained at the required degree of heating. No heating coils are being installed near the ceilings of the Sturtevant Kilns to prevent condensation drip from the roof, as has been done in the Tiemann Kiln, as the Sturtevant Co. do not think they will be required.

Of the two types of Kilns, the Tiemann will be the more useful for Research purposes, for which it is necessary that temperature and humidity conditions should be both accurate as well as constant, not only on the entering air side, but, as far as possible, in every corner of the kiln.

The Minor Forest Products Laboratory will be the scene of work which is to some extent done, at present, by the Forest Chemist. There will also be Fibre Retting Machines and appliances for testing various Tanning materials.

The Veneer Mill will consist of a small up-to-date Veneer Cutter and the necessary plant for steaming logs. The work will be of a purely experimental nature. Tests in the manufacture of three and five-ply wood as well as of the different adhesives, will also be carried out. The necessary Veneer drying plant will also be installed.

The Timber Testing Laboratory will contain fifteen or sixteen Testing Machines, capable of testing both small and large pieces of wood. The present Laboratory accommodates only four testing machines, of which three only can be worked, owing to the lack of electric power. The work of this branch will be extremely important. It requires thousands of individual tests to complete an inquiry into the properties of a single species so far as strength is concerned. Apart from the variations in strength due to locality, numerous others have to be taken into consideration, such as the weight of the specimen, its moisture content, its position in the tree (*i.e.*, height, also distance from the pith) and the rate of growth. The variations caused by defects also have to be considered, though the first tests are carried out with clear specimens only. Normally seven different strength tests are carried out for each kind of timber. These are—

1. Static bending.
2. Impact bending.
3. Compression parallel to grain.
4. Compression perpendicular to grain.
5. Hardness. (Tangential and radial).
6. Shearing. („ „ „).
7. Tension. („ „ „).

Other special tests can also be carried out, *e.g.*, the test for Spike pull when a timber is being tested for Railway Sleeper work.

The Wood Workshop will include all the machines at the present Wood Workshop. There will also be a four square cutter which will edge, surface and mould all in one operation. From a Research point of view a Wood Workshop is essential. Apart from the work involved in the preparation of true planed specimens for the Timber Testing Laboratory, there will be a great deal of experimental work in connection with the behaviour of different species in different sizes and thicknesses, under different methods of treatment.

The above description of the Forest Research Institute (present and future) aims at showing that the sanctioned scheme of expansion necessitated a "New Site." Very little attempt has been made to justify the sanctioned scheme, as the value of progress in Forest Research and Forest Education has been taken for granted. In view of the possible action of the Inchcape Committee, this aspect of the question will be discussed below.

THE VALUE OF FOREST RESEARCH AND EDUCATION FROM A FINANCIAL POINT OF VIEW.

The cost of Research.—In view of the fact that the value of Forest Research and Education cannot easily be reckoned in rupees, annas and pies, the opinion is often expressed that the scheme of development already sanctioned is far too ambitious, and that the expenditure will not be justified by results. It is often stated that money should not be spent on research and education at the expense of forest works in the provinces, as these last produce more revenue in shorter time. A detailed discussion of the value of Research work, particularly in the Economic Branch, will clearly establish the fact that Research work 'pays'. Up to the present the expenditure on the Forest Research Institute has not exceeded 2½ per cent. of the gross expenditure of the Forest Department, surely a very small percentage. If those officers, who are responsible for the carrying out of Forest works, think this is too large a percentage, they should remember that

expenditure on Forest works is almost entirely a Provincial matter, whereas Research is an Imperial Government concern. It is up to local officers to make out better cases for themselves with their Provincial Governments if they require money urgently for works. It should be remembered that the shortage of officers very often prevents schemes from being worked out carefully in detail before they are put up to Government for sanction, and that the failure of immature schemes results in Government losing confidence in the good judgment of their officers. The present financial stringency should at least have the effect of making us realise that it is better to be content with one or two really productive, and carefully worked out schemes, than to aim at producing revenue in all directions by an indiscriminate expenditure of money. It should help us to realise that it is better to refuse money for schemes unless the whole expenditure necessary for success can be sanctioned. It is no use launching a big felling scheme unless the necessary expert staff and equipment are forthcoming for handling the material after it is felled, and for disposing it of to advantage later on.

Effect of the present financial stringency on The New Site Scheme.

As stated above it is expected that the Inchcape Committee will have a 'cut' at the New Site scheme. The Government of India have already largely anticipated events by putting a stop to all fresh constructional work. Only the workshops of the Economic Branch are being built and fitted. But even the fate of the Economic Branch is still in the balance. The uncertainty is causing a great deal of harm, as the specialists who have been engaged on short term contracts are anxious about their futures. Their contracts expire in a few months' time. They feel that they have been able to do very little of the work for which they were engaged. They have not, for instance, been able to train any Forest Officers to take their places, as Government would not allow any appointments to be made Nor have these experts been able to organise their respective sections and get them into proper running order. The necessity for retrench-

ment has considerably delayed the construction of the buildings of the New Site, and has hampered the work of Plant erection. An instance of this is the action of the Mussoorie Dehra Dun Municipalities who had arranged to supply both electric power and water. The supply of electric power was due in October, so that the Iron Workshop machines could be worked in connection with the erection and fitting of the various plant. The power was supplied only quite recently, with the result that the fitting has had to be done largely by hand, a very tedious business where so much threading and drilling was necessary. With regard to the water-supply, the Municipality recently, quite suddenly, announced that they were unable to put it in at all, owing to the suspension by the local Government, of the necessary grant. This is a very serious matter. The Forest authorities are now faced with the problem of putting in their own water-supply. This was the original intention, but was dropped when it was thought that a combined scheme with the Dehra Dun Municipality would prove better and cheaper. There are now two alternatives. One a temporary scheme for filtering the canal water, which would cost about Rs. 44,000 and would provide water for the boiler and kilns within three or four months of the work being undertaken. This water would be of doubtful value for drinking purposes. The other scheme is of a permanent nature, and is estimated to cost about Rs. 2,10,000. This would furnish water fit for drinking within ten or twelve months. The authorities here are in favour of the latter scheme, and are pressing Government to sanction the necessary expenditure as soon as possible. In the meantime the kilns and the plant dependent on the Boiler cannot begin work, though all the fitting and erection work is expected to be quite complete by April next. Thus there is no hope of the New Site being in working order before the various experts who have been engaged are due to leave India. All are hoping that the Inchcape Committee will make it possible for Government to renew their contracts before it becomes too late.

The need for Commercial Research.—As stated above, the value of Research work cannot be gauged in rupees, annas and pies. It needs to be pointed out, however, that Research performs

a double rôle. More important than its function of producing direct revenue is the part which Research plays in the saving of expenditure. To perform these two functions the work must be properly organised, and should be carried out by well trained and efficient men. In other words, the work should be done by experts, who should be furnished with such equipment and staff as they consider necessary for the carrying out of a full programme of development. A few, somewhat spectacular, instances of the extraordinary results which have recently been achieved at Dehra Dun may be quoted, but these instances do not represent the real value of the bulk of the Research work which is being carried on from day to day. Much of this work must necessarily be concerned with the collection, classification and collation of data. Recently a wood called Sundri (*Heriteria minor*) has been substituted for Hickory in the manufacture of Sucker Rods for the oil wells in Burma. *Terminalia tomentosa* has also been tested, and it is believed will prove a success. The replacement of Hickory by Indian woods will, in this case, lead to a saving of several lakhs of expenditure, as Hickory, an American wood, is becoming scarce and very expensive. Another important discovery which will bring in lakhs of revenue to Government is the discovery, by Dr. Simonsen, the Forest Chemist, of the catalytic action of Pyrogallol in preventing the oxidation of Indian turpentine. As a result of this discovery it will now be possible to advertise Indian Turpentine, Grade I, as equal in quality to the best American. The discovery will cost practically nothing to put into operation, but will make a marked difference to the revenue budgets of the Resin Factories. Another very remarkable discovery by the Forest Chemist is that the drug Santonin can be inexpensively extracted from the plant *Artemisia maritima*, which is a common plant in Kashmir and parts of the Punjab. Mr. Coventry, of the I. F. S., till recently Conservator of Forests in Kashmir, initiated the enquiry which led to the discovery. Santonin used to be obtained chiefly from Russia. Owing to this source of supply having ceased, the drug has become very expensive· it is used chiefly as a vermicide. As the result of the above-mentioned discovery the collection of the plant will be undertaken

on a commercial scale. One collector started collecting just as the last season was closing and, without any proper organisation, succeeded in collecting in a short time sufficient raw material to make enough Santonin to fetch fifteen lakhs of rupees at the present price of Santonin. The price is, of course, bound to come down as the output increases.

These striking instances are given to prove that Research work may be justified simply by one or two lucky discoveries. But the general value of Research Work is worth very much more to the country. The work which is being done, for instance, by the experts of the Economic Branch is certainly worth lakhs of rupees a year. They would be worth considerably more if they had sufficient staff and equipment to enable them to carry out a full programme.

The ultimate goal of this scientific research is to develop the natural resources of the forests and thereby the trade and commerce of the country. India may be rendered more and more independent of outside commodities by intelligent application of the vast esources which at present remain unexploited, but to achieve this nd research should not merely keep pace with industrial and economic developments it should anticipate actual requirements so as to initiate new enterprise. Hitherto forest research has lagged years behind the requirements of the country.

The value of the Economic Branch.—It is, unfortunately, well known that Teak, Sal, Deodar and some well known Australian and American woods are generally preferred, in India, for all constructional purposes. Even for Railway Sleepers hardly any other species are in general use. The Timber Testing Officer at Dehra Dun is now demonstrating to us that there are several cheaper timbers which are stronger, and in some ways better, than those mentioned above. Some of these cheaper timbers even approach mild steel in strength. But because they are a little bit difficult to season, or are subject to white-ant attack when placed in exposed situations, they are hardly ever used. Seasoning and Preservation are generally regarded as expensive luxuries only because hardly anyone in India knows anything at all about them. Now, the Seasoning Specialist at Dehra Dun can, if given

the chance, show how successfully, and comparatively cheaply, the most refractory timbers can be seasoned, either by natural methods, or by means of a Dry-kiln, as circumstances may require. Similarly the Preservation Specialist will, when he materialises, demonstrate how timbers, treated for special purposes, are still cheaper, and, probably, better than some of the naturally immune timbers. (At present the Preservation Section is in charge of the Forest Economist himself.) The work that these officers are doing has hardly yet begun to bear much fruit, owing to their activities having been restricted through the want of staff, equipment and funds. But once these disabilities have been removed, and the general public have been provided with hard facts, which will open their eyes to the value of Indian timbers, there will be a wonderful change in the present state of affairs. Instead of the market being flooded with expensive foreign timbers, the foreign market will be demanding Indian timbers. This state of affairs can only come about as the result of definite Research work along the lines of Timber Testing, Timber Seasoning and Timber Preservation. It may also be anticipated that there will not only be an increase in the export of timber, and a decrease in its import, but also a very material increase in the local consumption of Forest Products generally. Timber is, of course, an ideal material for constructional purposes on account of its light weight, durability, strength, adaptability and low cost. Yet in 1913 the consumption of wood, per head of the population, was only 0·8 c. ft. in India. In America, during the same year, the consumption was as much as 260·0 c. ft. per head. These figures will show how much room there is for the development of the forest resources of a country, the percentage of forest area of which is as great as that of the United States.

An example of the value of a Research Officer's opinion, even before he has had time to do much detailed work may be given. The practice in this country with regard to the seasoning of timber is to "season it in the log." This fact alone probably accounts for a great deal of the prejudice which exists against most timbers except teak. The latter is supposed to be seasoned by means of girdling prior to felling. The real object of the

girdling is to get rid of some of the free water which the tree contains when green, so as to make the timber light enough to float. Most other species will suffer from insect and fungus attack if allowed to remain girdled for any length of time. Consequently these other species do not get such a good chance of drying as does teak, that is to say of drying "in the log." As a general rule logs are sawn up by hand into the particular sizes of scantlings and planks that are required for a particular purpose, and the sawing is usually done 'on the spot'. The sawn timber, therefore, has very little chance of seasoning before it is actually used. Even in the case of large sawmills in India a Seasoning Kiln has not, so far, been considered a necessity. And extremely little trouble is taken to see that the Mill sawn wood is properly air-seasoned before it is sold or used. The protection of the sawn wood from the deteriorating effects of sun, wind and rain is often a matter of chance. In view of the fact that teak is much drier than other species to begin with, and as it possesses a natural oil, which, on exposure to the air, and particularly to heat, forms a waterproof like layer on the surface of the wood, it is able to withstand changes of temperature and humidity better than other woods, even though it is still *quite green.* If Teak had not had these peculiar advantages over other woods it is very likely that the question of seasoning would have been taken up and studied properly long ago. Unfortunately the climates of England, Germany and France, where Forest Officers have received their training, are such that the question of seasoning does not assume much importance. It is in America that the subject has been properly studied, because the climate of that country is much more like that of India, that is one of severe extremes. India is, of course, worse even than America. The American seasoning expert at Dehra Dun thinks that it would not be an over-estimate to say that the practice of "seasoning in the log" loses the Department a large proportion of its revenue from Timber, and he is definitely of the opinion that "no seasoning at all" is better than "seasoning in the log," by which he means that timber should, as a rule, be converted as green as possible, and then seasoned in the converted state. Any Forest Officer with

experience of Timber Depôts knows that a fairly fresh hardwood log, which is worth about Re 1-8-0 a cubic foot soon after felling, may not fetch more than Re. 0-4-0 to Re. 0-8-0 a cubic foot soon after lying two or three years in the jungle and sale Depôt. The exploitation of softwood logs is hardly even attempted in most places. The deterioration is brought about by splitting, cracking, rotting and insect attack. Once seasoned and properly stored, sawnwood (lumber) is subject to very little danger from any of the above causes of deterioration. The sooner it is realised that *timber will not season in the log* the better. A very striking instance of this fact may be quoted as a clear proof of the assertion. Mr. Sweet, the Seasoning Expert at Dehra Dun, was asked the other day to advise Messrs. Bird & Co. at Delhi in connection with the kiln-seasoning of small scantlings of Burma Teak, $30'' \times 3'' \times 3''$ in size, required in the construction of plugs for insertion in the patent Stent Concrete Sleeper. In view of the dry climate of the Punjab it is necessary that these plugs should be dried down to a moisture content of 5 per cent. of the bone dry weight of the wood. If the plugs were inserted in a less dry condition than this they would contract in dry weather and fall out. Now, although these Burma Teak scantlings were received at Delhi in the converted state, they possessed, on an average, a moisture content of not less than 25 per cent. Even after 21 days' drying in the Sturtevant kiln which had been erected by Messrs. Bird & Co., these scantlings were brought down to an average moisture content of 15 per cent. only, instead of the required 5 per cent. It was on account of this difficulty that Mr. Sweet's help was asked. This instance is mentioned merely to illustrate that even small scantlings of so-called seasoned Burma Teak are far from being seasoned. It is only the natural oil in the wood which makes it respond so slowly to changes of humidity and temperature that makes teak behave as if it were seasoned. It may well be imagined what little chance other species have of being "seasoned", if this is the condition of Burma teak. The trouble is that hardly anyone knows anything at all about timber seasoning in India. We still have to learn how to handle our logs and dispose of our timber. We also

have to learn the extent to which different timbers have to be seasoned for different purposes, and for different localities. At present no one cares for such important details in connection with the utilisation of timber in India. In fact hardly any of the people who deal in timber in this country know even how to determine the moisture content of a piece of wood. It is certain that if all the timber sold by the Forest Department were sold with a guarantee that it was seasoned within certain defined limits, the revenue of the department could be greatly increased without any increase in output. If the idea were carried a step further, and measures were introduced with a view to standardising, not only the amount of seasoning, but also the sizes and qualities of timbers offered for sale, all classes of timber users and producers would benefit to an extent at present quite undreamed of. A great deal of work will have to be done first by the Timber Testing Officer, before any proper system of standardising can be introduced. It is estimated that in America a reduction of 20 per cent in standard sizes has been effected as the result of Research Work by the Forest Department. This means a saving of 40,000,000 dollars a year to America, if she acts up to the information available. Anyone requiring further information in connection with the problems connected with the seasoning of Indian Timbers should read the Forest Record by Mr. Sweet on "The Air-Seasoning of Indian Timbers" which has just been issued from the Government Press, Calcutta.

(*To be continued.*)

R. P. DALLEY, I.F.S.

ARTOCARPUS HIRSUTA AS AN UNDERWOOD FOR TEAK.

One of the problems, laid down for solution, in Bourne's Working Plan for the teak plantations in the Nilambur Valley is that of establishing an underwood.

It is clearly indicated that the species chosen should be evergreen, as during the growing season it will be subjected to heavy shade—the density varying with the age of the teak crop under which it is introduced.

Sporadic experiments have been made during the last two or three years with *Hopea parviflora* and *Artocarpus hirsuta*, but owing to the Moplah rebellion, these have failed through insufficient weeding.

With a view to restarting the experiments at the beginning of the next growing season I visited, last September, some plantations of teak at Koni, in Travancore, where Bourdillon, in his "Travancore Timbers" mentions a successful introduction of *Artocarpus hirsuta* as an underwood.

The area in question is probably as good as any in the neighbourhood, and the factors of the locality correspond very closely to those of the best areas at Nilambur. The plantation has an elevation of about 100′ and slopes gently towards a river. The annual rainfall is about 120″, but is, I think, more advantageously distributed than at Nilambur, as the South-West monsoon is generally lighter and the North-East heavier in Travancore than in Malabar.

Three or four attempts to establish *Artocarpus hirsuta* were made between 1892 and 1900 under teak of varying age; in every case germination took place, but no seedlings survived two hot weathers. "In 1904" (I quote from information supplied by the D. F. O.) "the plantation of 1867 (10 acres) was undersown with *anjilli* seeds (*A. hirsuta*). The ground was cleared of all undergrowth, the seeds were sown broadcast, and *the soil was then hoed up with spade and pick-axe and the seeds covered with earth.*

All the seeds germinated and the plants are thriving well, though they are damaged every year by wild elephants. The trees are now 18 years old and the biggest measure 38″ at breast height. Weedings were done regularly till 1914."

Equal success was obtained by similar methods in 1907. The D. F. O. gave me the girths of 20 trees recently measured in the 1904 and 1907 experimental areas. The average was 27·9″ and 26·0″ respectively. I am not clear, however, on what principle these 20 trees were selected. The ground is seriously overstocked and the actual average tree probably does not exceed 18″ in girth.

I myself selected a number of dominating trees in the 1904 area, if any tree in an underwood can be called dominating, which, in my opinion, were worthy of encouragement at the expense of the neighbouring saplings, and the average of these worked out at 8·2″ diameter—taking two diameters at right angles for each of 15 trees—with a height of 47′.

I selected a typical square chain of ground and counted on it 5 teak standards and 93 *anjilli (A. hirsuta)* saplings, a number which gives some idea of the density of the crop.

Here and there saplings more isolated than their fellows attained a girth of from 36″—44″ and it seems almost certain that normal thinnings in the past—even at a loss, for there is no local market for saplings—would have ensured an exceedingly valuable secondary crop which could be profitably left for 15—20 years after the teak is removed, say in fifteen years time, to the benefit of both the state revenues and the soil.

Apart from financial considerations of the future, the teak is definitely freer from epicormic branches than that in the pure plantations of equal age. The difference is certainly small, but the teak was 39 years old when the *anjilli* was introduced and most of the epicormic branches were by then firmly established.

I saw also a plantation of 10 acres where teak and *anjilli* were simultaneously introduced in 1906 at a spacing of 3′ × 3′. Generally the *anjilli* has held its own and is competing on equal terms with the teak, though in small patches here and there only teak is to be found.

This system has obvious advantages, and the Travancore Forest Department do not appear yet to have decided which species they propose to favour.

If, however, a complete underwood could be established in a plantation of teak just before its second or perhaps third thinning, it should grow up fast enough to suppress epicormic branches on the teak, while judicious thinning would prevent any interference with the crowns of the main crop.

I am much indebted to the Conservator of Forests, Travancore, and the District Forest Officer, Koni, for the information and assistance I received and perhaps others with experience of the subject could offer suggestions.

J. M. SWEET, I.F.S.

NATURAL REGENERATION OF EUCALYPTUS.

In December 1921 Mr. Marriott, Deputy Conservator of Forests, Ranikhet, wrote to say that there was some natural reproduction of eucalyptus in his division. He reported as follows :—

"There are some small patches of thick seed regeneration of eucalyptus in a forest in this division. The forest is a *chir (Pinus longifolia)* forest with four or five eucalyptus trees in it. It was all severely burnt in the forest fires, in fact it is one of the most badly burnt bits of all and the eucalyptus seems to have come up in consequence."

Enquiries were at once started with a view to identifying the species, and it soon became evident that there was more than one species of eucalyptus near Ranikhet. From specimens collected by Mr. A. E. Osmaston and by Forest Ranger Durga Dutt it appears that two species, *viz. E. Globulus*, Labil. and *E. dealbata*, A. Cunn., have regenerated naturally as a result of the fire which occurred on 12th May 1921.

Regarding *E. Globulus* Mr. Osmaston reports that in the forest near Dalmoti Bungalow, elevation 5,500 feet, there are about a dozen trees at wide intervals, the largest being 6 ft. girth by about 120 feet high. Regeneration 1—4 feet high was found all round the largest specimen. Regeneration of this species was also found at Jagdeo.

At Dalmoti there is a single specimen 6 feet girth by about 100 feet in height of *E. goniocalyx*, F. *v.* M. (probably, but the specimens are incomplete) which does not appear to have regenerated.

At the old Jagdeo bungalow, elevation 5,600 ft., there are several specimens of *E. dealbata*, A. Cunn., planted at about 20 feet intervals. They are from 18 inches to 3 feet girth and 30—60 feet high. Regeneration was seen by Mr. Osmaston in several places, the seedlings being 6—18 inches high but not plentiful.

E. dealbata, A. Cunn., is recorded as having been tried in Saharanpur in 1879, and in 1881 was reported to be "weak looking." In the plains of the Punjab it was tried at the same time but the "seedlings withered and died from the hot winds." As far as is known this species is not now grown anywhere in the plains of N.-W. India, but as it is very like *E. tereticornis*, Sm., and has usually been treated as a variety of that species, it may have been overlooked.

The Jagdeo plantation was started in 1875-76, and the one at Dalmoti in 1877-78. In the former 53,661 and in the latter 4,786 Eucalyptus plants had been planted by 1883, but they mostly died of frost or drought. It appears that 15 species were raised from seed but the names are not recorded.

This instance is believed to be the only case in which any natural reproduction of eucalyptus has been noticed in India except in the Nilgiri hills. In hill forests worked for firewood it might be worth trying direct sowing of eucalyptus in burnt patches, but as *E. dealbata* does not appear to have reached more than 3 feet girth in 40 years it is evidently not a tree to be recommended.

In conclusion I have to thank Mr. J. H. Maiden, F. R. S., Government Botanist, Sydney, for kindly confirming the identification of *E. dealbata.*

R. N. PARKER, I.F.S.

EDITORIAL NOTES.

"We understand that Mr. W. Raitt, Officer in Charge, Paper-Pulp at the Forest Research Institute, has been elected a member of the Institute of Chemical Engineers, London, in recognition of his original research work on Paper Making, and we beg to tender to him our congratulations."

REVIEWS AND EXTRACTS.

FOREST ADMINISTRATION REPORT OF THE UNITED PROVINCES, FOR THE YEAR 1921-22.

The United Provinces Administration Report is always interesting reading, as not only are the reports generally well written, but the matter dealt with, culled from results obtained by an energetic and progressive body of forest officers. The report under review is no exception to the rule and could, without doubt, have been even more attractive had the writer been allowed to depart from the rigid classification of headings laid down by a Bureaucratic Government.

The alteration in area of reserved forest only amounted to 2 square miles, by additions to the Working Plans Circle, while the report foreshadows radical changes in the near future due to the revision in policy for Kumaon. The settlement of 1911—17 in Kumaon reserved large areas of forest, which had for generations been gradually devastated by the Kumaonis. These reservations, resulted in far better protection to the forests and in many places produced excellent natural regeneration, in other words, ensured supplies for future generation, moreover due to control, it was possible to greatly extend the rosin and turpentine industry, which afforded employment for thousands of coolies besides bringing in solid revenue to the Kumaon Administration. That the reservation benefited Kumaon as a whole, there can be no doubt. When reservation of forests is first brought into effect certain hardships naturally follow, this was found to be the case throughout India in the early days of the Forest Department, but looking back at the results achieved who can say that reservation was not the correct policy? Political experiences have now forced a different tune to be played in Kumaon, and large areas are to be released, while control in the remaining reserves is not to be complete, which can lead to but one result, namely, the gradual elimination of the material on which the people so largely subsist, When this occurs a " Grievance Committee " will be useless.

Under the head of Working Plans the reading is much more cheerful. The area for which original working plans are required is 964 sq. miles, while that required for revision plans amounts to 3,014 sq. miles. We go on to read that 940 sq. miles out of 946 sq. miles of the former, and 1,570 sq. miles out of the 3,014 sq. miles of the latter are in hand:—Such figures must turn many foresters of other provinces green with envy. The cost of enumeration is interesting; thus in Pilibhit the cost came to Rs. 237 per sq. mile, in South Kheri to Rs. 280 per sq. mile, in Dehra Dun to Rs. 92 per sq. mile and in Lansdowne to Rs. 160 per sq. mile. The cost of enumeration varies, of course, according to the density of the crop, the undergrowth and the configuration of the country so that large variations may be expected; on the other hand, even Rs. 237 per sq. mile is not excessive, as the amount in the heavy forests of the West Coasts, for instance, have gone to as high as Rs. 500 per sq. mile. A point of far greater interest to the forester is the percentage of the growing stock which is enumerated in each area, a point not referred to in the report. Perhaps the advanced United Provinces forest officer who has relatively small areas to deal with, is not satisfied unless he enumerates the whole of his growing stock, and so considers it unnecessary to refer to the subject.

We find that Rs. 93,592 were spent on new roads and bridges and Rs. 1,36,802 on repairs to existing lines of communication, or a total of Rs. 2,30,394. The Conservator, Eastern Circle, laments the want of funds for further improving communications, while Mr. Elliott, I. C. S., sings the same tune for the Working Plans Circle. Admitted that money is very tight at present, how is the difficulty to be overcome? Surely by productive works, especially when such works not only in themselves pay hands down, but have still further reaching effects in stimulating trade. Proof for this, can be had, if proof is necessary, by reading section 25 of the report which states that by extending the Jubileeganj railway siding by some four miles, it at once resulted in profits to the Department by improved auction bids and by royalty on the increased outturn. At the same time we read in this section that unfortunately no progress was made with the Kashipur-Kalgarh extension which is badly needed and that in the Eastern Circle a tramway is badly needed in Gorakhpur, and so on.

The report records a bad year of forest fires chiefly due to the incendiarism which occurred in the hot weather of 1921, especially in Kumaon. The number of cases taken to count rose from 16 to 139, while convictions were obtained in the majority of cases. It is gratifying to note that adequate sentences were given, running up to 7 years hard labour.

A point of interest under the head of "Protection" against "injury by insects" is recorded referring to the case of the sal borer in the Thano forests of the Dehra Dun Division, where the recommendations of the Forest Entomologist have been given effect to, with a view to keeping this pest within bounds. Similarly cases are recorded in the Chakrata and Banda Divisions regarding other pests. These are instructive instances of the practical application of advice tendered by the Entomological Branch of the Forest Research Institute.

Natural regeneration in most divisions was unsatisfactory: in the case of sal, due to absence of timely rains; in other instances due to the trees producing no seed, while existing regeneration was severely damaged by what the Chief Conservator rightly terms "senseless burning." A certain amount of planting was done in several divisions, while cultural operations, creeper cutting, etc., covered 31,673 acres in the Western and 24,207 acres in the Eastern Circle. In the Working Plans Circle the work in the afforestation division is said to have been very successful, and looking at past results of afforestation in the United Provinces one can but be filled with admiration, the more so, if one has served in the dry zones of India.

Under departmental agency only some $2\frac{3}{4}$ lakhs of timber were exploited, while minor products stood at 14 lakhs, chiefly due to the activities of the resin division. And yet one reads that 1,686,663 trees were set up with 1,856,673 channels at the beginning of the year, but owing to incendiary fires tapping had to be discontinued on 1,152,715 channels, while the yield fell from 91,978 mds. in the previous year, to 27,408 mds. in the year under report. Truly a nice state of affairs.

The Utilisation Circle report is interesting reading but for want of space the Chief Conservator confines himself to a very

brief review. He very pertinently starts his remarks by stating the resolution passed by the All-India Utilisation Conference held at Dehra Dun during the year and points out that the most obvious means of fulfilling the principles laid down in the resolution, is the creation of a sale agency to act as a link between the territorial officers and the markets. This has been done and a Timber Supplies Divisional Officer appointed, whose activities are manifold, and have led to very satisfactory results His duties are (*a*) to supply timber for the utilisation circle, *i.e.*, to meet the demand of the Sawmill and Turnery and Resin Factory and (*b*) Sell timber for other circles. To follow closely the activities of this division, and those of Wood Technology Sawmill and Turnery and Rosin and Turpentine could, as matters now stand, lead to no great advantage, as an entirely new policy is under consideration. It is understood that it is contemplated to hand over the Wood Technology division to the Industries Department and to try and form the Clutterbuckgunj portion of the Utilisation Circle into a Company. Whatever may eventually be decided regarding these departmental ventures, it is clear that the Bareilly organisation has, in the past, fulfilled a very definite function. We have from time to time heard much adverse criticism on Bareilly not only from outside but also from the department. Bareilly was often very unpopular with territorial officers, and the profits may not always have been all that was expected. Nevertheless, the conception of the Wood Working Industry, Sawmill, Turnery and Resin Factory was a great step forward in Utilisation, which taught the Department more in Utilisation than anything else, in that it clearly pointed out what could and what could not be done and at the same time has been largely instrumental in stimulating other provinces to develop their forest resources, and to help them in framing definite policies of their own. Bareilly, from an Imperial point of view, has been a great success if not all that might have been expected from a provincial standpoint.

Turning now to Chapter V, on Finance, the gross receipts were $86\frac{1}{2}$ lakhs of rupees as against $87\frac{1}{4}$ lakhs for the previous year. Expenditure amounted to 74 lakhs as against $70\frac{1}{3}$ for 1921-21, while the profits of 1921-22 were Rs. $12\frac{1}{2}$ lakhs against

nearly 17 lakhs of rupees in 1920-21. Though these figures do not show great variations, those in the various circles are very considerable, due to the transfer of several units from the Kumaon to the Utilisation Circle, such as the Resin division which accounted for Rs. 8,82,000 either way. Then again, the Western Circle revenue was decreased by $5\frac{1}{2}$ lakhs of rupees due to less Nepal timber being exploited. The average net revenue for the preceding five years was 20 lakhs of rupees so that the financial results of the years under report were not altogether satisfactory, nevertheless when one takes into consideration the political situation and the slump in trade which had already made itself felt at the time, it is unnecessary to be despondent as to the future. The future in fact depends on two main factors (*i*) a forward policy in Extraction, which mean money well placed on roads, railways, etc., and (*ii*) Sound Utilisation methods, backed by correct translation of results of research into commercial propositions.

Under the head "Research and Experiments," a large number of experiments are very briefly recorded. It would, we think, have added to the value of the report had they been classed according to subjects, instead of being mixed up and dealt with according to Circles. Then again, in several instances the experiment is notified, but the report is silent as to the result. The experiments under the head of Silviculture far outnumber those under other heads and that is as it should be. Officers wishing to follow up these experiments must consult the special report on the subject, a copy of which has been forwarded to the President, Forest Research Institute, Dehra Dun.

R. S. P.

A SHORT TREATISE ON THE MANAGEMENT OF ELEPHANTS.

BY A. J. W. MILROY, B.A., I.F.S.

Price Rs. 2, obtainable from Officer-in-charge, Secretariat Book Depôt, Shillong, Assam.

We have read with considerable edification this short treatise and can recommend it as a useful handbook that should be given

to every young Forest Officer who is likely to have anything to do with the handling of elephants. The treatise deals with the subjects from the practical side and contains a number of practical hints of value. Especially good is the manner in which Mr. Milroy emphasises, that a study of the natural habits of elephants should form the basis of all arrangements for the attention and care required in their handling. While agreeing, that when properly handled, elephants are not delicate animals, we do not see the necessity for the continual reiteration of this fact, especially in a handbook written ostensibly for young officers. The detailed notes that Mr. Milroy gives are sufficient to prove that an elephant is immediately affected by any unwise handling. An elephant in its natural existence is not a delicate animal, but it must be remembered that elephants are not like most domesticated animals of burden, that have been bred in captivity, and have gradually acquired the habit of life suited to the requirements of their domesticated form of living. Elephants have rarely been more than 1 or 2 generations in captivity. The majority is even born in the wild state, and it naturally follows that great care must be taken in accustoming elephants to conditions and work that are not natural to them. The treatise deals under separate chapters with the following subjects :—

(1) General, *i.e.*, Identification, types and good and bad points; points to be noted when purchasing new animals.

(2) General management and feeding. This is very well dealt with.

(3) Working.—This portion suffers from a general point of view, in having no reference to the dragging of timber, which in Burma, at any rate, is of primary importance, but it is obvious that Mr. Milroy has had little experience of this branch of work, as elephants are not used for dragging to any great extent in Assam.

(4) Gear and loads.—This again makes no reference to dragging gear.

(5) Ailments and diseases, with the more simple remedies and treatment.

The treatise concludes with a useful glossary of terms, and a number of photographs illustrating the different types of elephants and gear. The photos of elephants have not been treated very well in reproduction and do not give a very good idea of the types they are supposed to illustrate.

The treatise is, of course, written by an Assam Forest Officer mainly for the benefit of officers employed in Assam and similar localities, such as Bengal. Naturally, therefore, it deals at some length, with the artificial life of an elephant at *pilkhanas* (elephant-lines) and with handfeeding; but the author quite rightly emphasises the advantages to be gained, where natural fodder is plentiful, of allowing the elephant to find its own food, while preventing it from straying by hobbling its forelegs. In Burma, with its wider forests, and greater abundance of natural fodder, a good many of the directions with regard to feeding and to permanent *pilkhanas* are unnecessary.

We have sent this book to one of our elephant experts, who has kindly supplied the following notes:—

"The author has no objection to mahouts riding at ease on the top of the baggage and occasionally poking the elephant's head with a stick. A much better pace, and better control is obtained, by the mahout's riding on the animal's neck, and occasionally tickling its ears with his toes. Rope stirrups may be used with advantage both to prevent tiredness in the mahout's legs and to keep his feet well forward against the elephant's ears.

"No mention is made of the advisability of personally seeing the girths are pulled tight before a loaded elephant leaves camp, nor of the mahout's massaging the elephant's back after unloading, two practices which go far to prevent girth-galls and sore-backs.

"That paddy fed to elephants should be well boiled before mixing with salt, is not mentioned. Unless this is done,

much paddy will pass through the system undigested, and colic and indigestion may result.

"Another point which might have been mentioned, is the advisability of every officer travelling with elephants, taking, as a regular part of his kit, such simple medicines as iodine, zinc ointment and dusting powder, and on a long tour, purgatives and some iron tonic, powders or balls. Solutions of salts giving off free chlorine, which are found very effective in cleaning up suppurating wounds, afford a non-bulky and useful adjunct to the medicine chest, and might well be included."

Without detracting in any way from the general usefulness of the book, it must be admitted, that the work lacks arrangement, and gives the impression of consisting of a number of loose notes strung together without very much continuity. Above all, it has suffered exceedingly in the hands of the printer. It is comforting to find that, even the much maligned Burma Government Press can, as a general rule, turn out a better article than this sample of the work of the Assam Government Press, Shillong.

H. R. B.

THE COMMERCIAL TIMBERS OF INDIA.

How many Indian Timbers are well known in the commerce of the world? You can count them on the fingers of one hand; teak, padauk, rosewood and satin wood. In contrast to this, what use does India make of imported timbers? You can see every day mahogany furniture, Japanese tea boxes, beechwood bobbins from England, railway carriages panelled with American oak and maple, sleepers of Canadian Douglas fir, wharves with greenheart piles from Guiana, satin walnut picture frames from the U. S. A., bentwood chairs from Austria and a host of other uses.

Why does such a state of affairs exist; is it inevitable? Not in the least. India contains within her own frontiers timbers which can replace imported timbers for everyone of the abovementioned purposes and many more in addition. Those foreign

timbers come from every climate and yet India, stretching over 24° of latitude and with every elevation from sea level to the highest tree limits in the world, has forests of almost every type to be found on the face of the earth.

The variety of timbers to be found in India is surprising when the subject is looked into. A very moderate estimate would put the number of timber yielding species at three *hundred* ranging in hardness from the spongy light timber of the common *simal* or cotton tree to the bitter hardness of *pyingado* or iron wood and in strength from the poplar of the Punjab to the tenacious *sundri* of the deltas. The range of colour is equally wide from white to coal black, from pale yellow to blood red.

Unfortunately very few people outside the Forest Department know what timber there is, and what it is like. In the south there are the *Calophyllums* or poon spar trees with their clear boles, even grain and strong timber which gained them much esteem when the H. E. I. C's ships had to be refitted in India. In the very important family of the *Dipterocarps*, to which sal belongs, the great value of the various species is well known by the local populations, but how many timber traders know the strength and durability of the *Hopeas*, the general purpose timbers of the *Parashoreas* and *Vaterias*, and the firm even grained wood of *gurjun* and *eng*? In this last connection it seems curious that we find Siamese *mai yang* stipulated in contracts in India when identically the same timber grows in Burma!

If we group the timbers by their qualities we can mention *toon* and *thitka* as mahogany substitutes, Andaman marble wood for bizarre effects in furnishing, *Gluta* and *Millettia* for wealth of colour and beautiful grain, *asna* for colour and figure, *kokko* or *siris* as a walnut substitute, *pyinma* or *jarul*, *Chikrasi* and *Berrya* for general furnishing, *pyingado*, Bullet wood and *sissoo* for strength, hardness and durability; *kusum* and *anjan* for wry hardness, mulberry and *pettham* for elasticity, *haldu* and *bhinga* for bobbins, and general turnery, the *Gardenias* for boxwood substitutes, while the spruce and silver fir of the Himalayas are in every way comparable to those of Europe and America.

Given such wealth of species, and such a diversity of qualities, to suit almost every requirement, it is only natural that people

should ask why so little use is apparently made of them? The question is obvious, but the answer is not nearly so simple. In so far as commerce is concerned the answer is "largely ignorance," for the reason that the indigenous uses of Indian timbers, though numerous, are not large in bulk, and do not strike the eye. Also commerce does not want to bother with experiment, finding it easier if not cheaper to buy other people's experience. Before beech was found suitable for bobbins, hundreds of unnoted trials were made in past centuries, which no one thinks of to-day but before our Indian *haldu* could find its place alongside beech in India, money had to be spent and mistakes had to be made.

The same applies to all the Indian timbers before they can be expected to bulk large in commerce. Ignorance is disappearing, but there are many other obstacles in the way of progress. One of the most serious is a natural one which cannot be avoided but which must be overcome. This is that, by far the largest part of the real timber forests of India are mixed forests, where many species grow mixed together indiscriminately, so that for any one species a forest containing one tree per acre of that species, ripe for the axe, may be called a rich forest. It has been estimated, for instance, that in ordinary teak forest in Burma, there are about sixty-four other timber species to be found growing together with the teak. A moment's thought will show that to have to pick out one tree out of every twenty or thirty, is going to make its extraction from the forest difficult and costly. On the other hand to take out all when a market is established for only one or two is equally expensive and wasteful as well.

Next comes India's oldest difficulty, transport. The bulk of India's existing forests are distant either actually or relatively from the main centres of population, for the very good reason that the population has done its best to push the forest away. If he shines in no other form of human activity the Indian peasant excels in abolishing forest growth.

Even when the forest is reached, the problem is no simpler. Our timberlands are in broken country, roadless for the most part and usually cut off from railways by large rivers. In other lands the river is often the means of extraction but unfortunately most Indian timbers do not float.

The delay in opening up the forest is due to the old cause, want of men and money. Governments and private individuals do not like to sink money when the return is not immediate, so in the past the available money has been spent in restoring the ruined accessible forest rather than on developing the more remote ones.

Added to this, timber is an expensive article to take by rail particularly in the round. As matters now stand it is impossible to take a sawmill to the forest if there are no roads, and it is almost prohibitive in cost to bring the log to the railway or along it, so that in too many places hand sawing in the forest is the only expedient, and an inefficient and expensive one.

These are some of the reasons why India's timbers are neglected by commerce both in India and outside. The only remedy lies in organisation. The ignorance must be dispelled by careful research, experiment and publicity. A start has already been made towards this at the Forest Research Institute, Dehra Dun. At the same time such work will be wasted unless the opening up of the forests goes hand in hand with investigation. Men and money must be provided at the right moment and for the proper period, not one man and a crore at one time, and ten men and ten rupees at another. If the timber trade in India is to prosper, those engaged in it will have to see that the State as the principal forest owner provides the men and the money. In addition the trade must give more attention to the technical aspects of handling timber. Timber traders in India seem to forget that the business does not begin and end with the felling, conversion and sale of timber. The timber which India imports so easily has in every case been selected with a view to its suitability for a particular purpose, in many cases it has been specially converted and specially seasoned as well. Too often in India a timber is chosen at haphazard, converted at the discretion of an ignorant sawyer, fashioned before it is seasoned and used under conditions which no one in Europe would dream of allowing, with the result that Indian timbers are given a bad name. The people who maltreat timber in this way would not expect a bit of bar iron to give good service as a high speed steel cutter, but to them timber is just timber and must not expect any consideration. If they would go

to the expense of a railway fare to the Forest Research Institute at Dehra Dun, or even of a one anna stamp they could save themselves much trouble. There, most of the commercial timbers of India can be seen and experts are at work testing them for strength, for durability, for seasoning, identifying and classifying them. Naturally, none of these experts would claim to solve every particular timber problem on the spot, but there is information to be got there, which, if it will not put timber dealers on the road to becoming millionaires, can at least save them from wasting money and point the way to making good use of India's timber resources.—[*Times of India.*]

AFFORESTATION IN KOREA.

BY PROFESSOR PERCY M. ROXBY.

While passing through Korea last year *en route* to China I was able to collect some interesting information about the wonderful afforestation scheme which the Japanese authorities are carrying out in that beautiful but long-neglected country. It is probably the most systematic and ambitious effort at afforestation on a national scale which has so far been attempted, and is not without its lessons for this country. A singularly favourable opportunity for State enterprise was presented by the fact that the Japanese Government, succeeding to the Crown Lands of the Korean Royal House on the annexation of the country in 1910, came into possession of about seven-eighths of the total area of "Hills and Mountains" (14,000,000 out of an estimated total of 16,000,000 *cho**), which constitute the greater part of the land-surface of Korea. This opportunity was eagerly seized by the new Administration, bent on the rapid economic development of the country, since afforestation was held to be an essential preliminary to both agricultural and industrial progress. Originally the granitic highlands of Korea were fairly densely wooded, but over the greater part of the country the natural forests have been almost totally destroyed, with results disastrous to both agriculture and pasturage. The only large area of primitive forest remaining is in the north-east, a portion of

* A *cho* is equal to 2 45 acres approximately.

the rich belt of mixed woodlands which occupies the basin of the Upper Yalu, and stretches northwards towards the Amur. On the Manchurian side of the border much reckless destruction of this important forest is taking place, but its exploitation on the Korean side is being carefully regulated. The Government have maintained a large lumber station (at Shingishū) which controls the use of the forest. The working principle at the present time is to cut down 1/120th of the forest each year and to replant to the same extent.

Meanwhile, the re-afforestation of the denuded highlands of central and southern Korea has begun in real earnest, and I was much impressed by the great progress which has been made since 1913 when I first travelled through the peninsula. About 2,50,000 *cho* have already been planted, one-half directly by Government, and the other by private individuals to whom the land is rented, on the express understanding, that planting shall be the first consideration. At the end of ten years that land will pass to the individuals concerned, provided that the Administration is satisfied with its forestal use in their hands. At present about 150,000,000 seedlings per year are being planted, at the rate of about 3,000 to 5,000 per *cho*.

On the hills the trees planted are mainly Korean pines of the two and five-leaved varieties. They come to maturity in about forty years, and are from 50 to 60 feet in height. The chief difficulty is to prevent depredations by the peasantry for purposes of fuel, and so, to prevent destruction of the hill forests, acacias, Lombardy poplars, and other quick growing trees are now being extensively planted on waste places in the lowlands and valleys for local use. According to the officials concerned with the scheme it is the intention of the Government to retain as State forest about six million *cho* of the large area at present under their administration, and to allow the other eight millions to pass into private hands on the conditions specified above.

The results anticipated by the Japanese forestry experts from this scheme, apart from the supply of timber essential to the development of many Korean industries, are as follows :—

(1) Modifications of climate : (*a*) value of trees as wind-screens ; (*b*) tendency to increase equability of

temperature; (*c*) probably a slightly increased rainfall, since the bare granite rocks when heated tend to check condensation.

(2) The prevention or at least reduction of both floods and droughts by checking the rapid run off of water from the hills. This of itself will be an immense gain to agriculture, but in addition it should be noticed that

(3) Afforestation is considered a necessary preliminary to the extensive irrigation schemes by which it is hoped to increase the agricultural area of the country. These depend upon the construction of irrigation reservoirs, which at present it is almost useless to make owing to their being quickly silted up by the torrential run of water.

(4) The development of cattle and sheep pasture.

(5) The preservation and improvement of the valued supply of fish in the rivers and estuaries, through the more even flow of water.

(6) It is also interesting to notice that the Japanese attach importance to the improvement of health through pine forests, both by their effect on the purification of the air, and by the enhanced beauty which they give to the landscape.

The cost to the Government of this big scheme, including the upkeep of the lumber station in the north, is estimated at about yen 3,500,000 per year.

To encourage popular interest in afforestation, Arbor Day (significantly fixed on 3rd April, the conventional anniversary of the death of the famous Jimmu Tenno, the first Emperor of Japan) has been made a national institution.

The afforestation of Korea has, of course, a high significance for China, which is faced with the same problems due to the destruction of her forests, but on a far more gigantic scale.—[*The Scottish Geographical Magazine, Vol. XXXIX, No.* 1.]

CORRESPONDENCE.

CALCULATION OF THE YIELD OF A FOREST BY FORMULÆ.

SIR,—In the December *Forester* you published an article by Mr. Smythies entitled "Calculation of the Yield by Formulæ" in which he quotes a formula of mine, namely—

$$Y = \frac{V}{\frac{3}{8} r}$$

The formula is applied entirely wrongly by Mr. Smythies. The "V" in the formula, as I published it, was stated to be trees of half the rotation age and over or, if a girth or diameter were substituted for age, the "V" is the volume of the trees of that size and over.

Mr. Smythies says on page 634, rotation = 90 years. Volume of trees of 8″ and over = 1,522 cubic feet. *Age of tree 8″ diameter = 35 years.*

He then uses the same denominator as in my formula, taking his "V," as all trees 35 years and over, and naturally, does not get the same result, as if he took trees of 45 years and over only, *i.e.*, half rotation age. He has taken his "V" too large and his yield of 45·0 cubic ft. is *not* the yield by my formula, it would be about 33 or 35 cubic ft. per acre, anyway less than 45 cubic ft.

The formula used by Mr. Smythies, is in words that, if the "V" is composed of trees of $\frac{7}{18}$ rotation age and over, the yield will be that quantity divided by 3/8 rotation. Such a formula has nothing to do with me.

S. H. HOWARD, I.F.S.

GERMINATION OF *BARRINGTONIA ACUTANGULA* SEEDS.

SIR,—In connection with the notes on *Barringtonia acutangula* with excellent photograph, which appeared in the *Indian Forester* for November 1922, I send the following notes about the tree :—

It has never been seen growing in the deepest part of the lakes (locally called *haors*) of Sylhet, and the reason seems to me that, since in those parts water never gets dried up even in the driest season, it is impossible for the seeds to get to the soil and germinate. In the photograph referred to above, it will be noticed, that about half of the crown of the tree is above water. The habit of the tree is to have a large spreading crown and a short bole. The photograph gives an excellent idea, therefore, of the depth of water of the lake, where the plant is growing. This is the condition of things during rainy season when the fruits also ripen. I may, however, point out that this condition does not last for months together, but at the most two or three months, after which the water subsides, exposing the soil here and there. It is in these places, that seeds, which remained floating on water, or some of them germinated even, strike root and new seedlings grow. One must not also forget, that every year the water level during rainy season does not remain the same, and also, the time of the highest flood varies. These two are obviously the most important factors, one has to reckon with, in dealing with the species, as its fruits ripen during rainy season. For, in those years in which the flood is late, the fruits may have already fallen, and seeds germinated on the ground, while in low floods, the water may not be very deep and may subside by the time the seeds are ready for germination. How long the seeds would remain sound, while floating on water, and even after germination, and how long the radicle would remain sound before rotting under water, without striking soil, will have to be considered. Once the young seedling strikes root in the soil, it goes on growing during spring and summer, till it is submerged by the next flood, a year after, and can stand waterlogging and

submergence for a considerable time. In this respect it is not much different from *Trewia nudiflora* which also grows in low marshy places subject to similar waterlogging and submergence, in and near the low-lying villages during rains. Like *Barringtonia*, *Trewia* fruits also float on water for a considerable time, till the water subsides when the seeds reach the soil and germinate.

Other plants that are equally adapted to submergence under water are *Bombax malabaricum*, *Lagerstrœmia Flos Reginæ*, and *Cratæva religiosa*. Excellent examples of the first two can be seen during rainy season between Jagi Road and Chaparmukh Section of the Assam Bengal Railway Line.

I may point out, however, that the statement that the plant germinates under water hardly seems to me to agree with the facts. The fruits of *Barringtonia* float on water like those *Trewia* as already mentioned, and as the seeds are provided with a hard testa, they can certainly keep sound for quite a long period, by which time the water may have subsided and the seeds may reach the soil. Wind also brings the fruits near the edges of the lakes where they germinate, and this agrees with the fact that the plant is never found in the deep parts of the lakes, but only on the edges.

As regards its growth under water, I have mentioned several species that grow equally well; as for its germination, one can see almost similar conditions in the germinations of *Vatica lancæfolia*, (*morhal* in Assamese), in Upper Assam. In the forests of Assam, in depressions where water collects during rainy season, it is not infrequently that one finds 50 to 100 seedlings of the plant in a square yard of place. A detailed examination, however, shows that the fruits which float on water must have been brought together near the water's edge by a current of running water or wind, and they have germinated there.

The lakes of Assam (*haors*, as they are locally called) are the remnants of the depressions in Tertiary times, parts of which have been filled up by the alluvium brought down by the rivers issuing from the hills on all sides, except on the west, on which side the Surma Valley has a downward slope, and towards which side all the chief rivers ultimately flow.

Harlow, C. M.

Central Provinces.—I.A.R.O., April 1917. Attached 1/32nd Sikh Pioneers, Mesopotamia. Captain and Adjutant. Recalled, March 1919.

Hargreaves, C. K.

Burma—I. A. R. O., August 1918. Attached Burma Rifles. Recalled, February 1919.

Hartnoll, E. S.

Burma.—I. A. R. O., October 1917. Attached 1/70th Burma Rifles, Palestine.

Hay, E. F. A.

Burma.—King Edwards Horse.—I. A. R. O., October 1917. 3/153rd Rifles, 1/70th Burma Rifles, Egypt.

Herbert, V. A.

United Provinces.—May 1915. Attached 14th Lancers, Mohmand Expedition, November 1915. Base Commandant's Staff, Marseilles, May 1916. Attached 29th Lancers, France, March 1918. Palestine, till May 1919. Adjutant of Regiment, January 1917 to May 1919. Awarded Military Cross.

Hewett, D. P.

Burma.—I. A. R. O., November 1917. 22nd Cavalry F. F. 3/70th Burma Rifles. Recalled, February 1919.

Hopwood, J. C.

Burma.—On leave. War Work in London.

Hopwood, S. F.

Burma.—Joined R. F. A., January 1916, when on leave. Wounded in France, September 1918. Awarded Military Cross.

Inder, R. W.

Bombay.—I. A. R. O., August 1916. Assistant Recruiting Officer, Berar and Khandesh, later transferred to Gujrat and Kathiawar. Recalled, April 1918. Captain.

Jeffery, G. R.

Burma.—Joined 20th Hussars when on leave. Killed in action in France, 14th February 1916.

Jenkin, R. T.

Central Provinces.—S. and T. Corps, April 1915. Assistant Postal Censor, attached 105th Mahratta Light Infantry, September 1915. S. and T. Corps January 1916. Afghanistan. Captain.

Jerram, M. R. K.

Punjab.—I. A. R. O., attached 2/2nd K. E. O. Gurkhas, 1915. Aden, France and Egypt, 1915. 1/2nd K. E. O. Gurkhas, Mesopotamia, 1916—1918. Attached 2/11th Gurkhas in India, 1918—1919. Severely wounded in Mesopotamia, 1917. Captain. Twice mentioned in despatches. Awarded Military Cross.

Jollye, H. C. B.

Central Provinces.—I. A. R. O., attached 31st D. C. O. Lancers, Kohat and Bannu, September 1916. Assistant Recruiting Officer, November 1917. Assistant Controller, Timber Supplies, Munitions Board, November 1918—March 1919. Invalided from Waziristan Field Force, August 1917. Captain.

Lawrence, A.

Burma.—May—August 1918. Staff Training.

Lyall, J. H.

United Provinces.—1/123rd Outram's Rifles, November 1916. Mesopotamia, March 1917. Attached 1/26th Punjabis. Baghdad, April 1917. Palestine July 1918. Attached 1/152nd Punjabis. Released, 16th April 1919. Captain.

Mackarness, C. G.

Assam.—I. A. R. O., November 1915. Attached 25th Punjabis. Assistant Recruiting Officer, April 1916. Attached 52nd Sikhs, April 1918. Palestine, Special Service Officer with Alwar Imperial Service Infantry (A/Capt.) to January 1919.

Mason, L.

Central Provinces.—R. F. A., October 1914. France, January 1915 to February 1919. A.-D.-C. to

G. O. C., R. A., 4th Division. Staff Captain, R. A., 4th Division. Staff Officer, R. A., 3rd Army. Acting Major, February 1918. Twice mentioned in despatches. Awarded Military Cross, O.B.E., Croix de Guerre Belge.

McDonald, D. C.

Central Provinces (P. F. S.)—I. A. R. O., attached 104th Wellesley's Rifles. Regimental Recruiting Officer, 1918.

Milne, W. C.

Bombay.—121st Pioneers, July 1916. Mesopotamia, March 1917. Died of enteric fever in Baghdad, 29th October 1917.

Milner, C. E.

Burma.—I. A. R. O, May 1915, 38th Central Indian Horse. France. Wounded at Cambrai, January 1918 to January 1919. Timber Supply Department, Board of Trade, to superintend felling and extraction of ash for æroplanes.

Milroy, A. J. W.

Assam.—I. A. R. O., January 1918. Attached 3/9th Gurkhas. Released, April 1919.

Milward, R. C.

United Provinces.—Attached 102nd and 101st Grenadiers and deputed to Kapurthala and Gwalior Imperial Service Troops. British East Africa, August 1915—May 1916.

Nicholson, A. R.

Bengal.—Mesopotamia. Twice severely wounded.

Nicholson, J. W.

Bihar and Orissa—I. A. R. O., August 1916. Attached 12th Cavalry, Mesopotamia, June 1917—March 1919.

Ogilvie, G. H.

Burma.—Censor at Rangoon. I. A. R. O., December 1914. 2/10th Gurkha Rifles. 2/3rd Gurkha Rifles, Dardanelles, Mesopotamia, Palestine. Wounded,

September 1918. Captain. Awarded Military Cross. Mentioned in despatches.

Owden, J. S.

Assam.—I. A. R. O., November 1915. Attached 4th Cavalry, Mesopotamia, April 1916. January 1917 joined R. F. C., November 1917, Aden with 1/14th Squadron. Wounded, January 1918. Recalled in 1919. Mentioned in despatches.

Parker, R. N.

Punjab.—I. A. R. O., October 1917. Assistant Controller of contracts in charge firewood supplies at A. H.-Q. (Temporary Major), December 1917. Recalled, March 1919.

Patterson, C. B.

United Provinces.—June 1915, attached 1/1st Gurkha Rifles. Attached 39th Garhwal Rifles, Mesopotamia. Attached 1/1st Gurkha Rifles. Killed in action, January 1917.

Powell, W. S.

Burma.—I. A. R. O., December 1917. 6th K. E. O. Cavalry, December 1917. Recalled, February 1919.

Rodger, A.

Burma.—Timber Supply (Munitions), 1917—1919.

Rowbotham, C. J.

Assam.—I. A. R. O., August 1916. Attached 1/123rd Outram's Rifles, November 1916. Mesopotamia, April 1917. Attached 93rd Burma Infantry, Palestine, May 1918. Suez, April 1919. Invalided to England, July 1919. Recalled, May 1920.

Scott, C. W.

Burma.—R. N. A. S., 243rd Squadron, R. A. F. European waters. Mentioned in Naval despatches, 1917. Mentioned in R. A. F. despatches, 1918. D. F. C., January 1919. Major.

Shebbeare, E. O.

Bengal.—I. A. R. O., June 1918. A. P. M., Calcutta. Recalled, August 1918.

Shepherd, W. S.

Burma.—I. A. R. O., June 1915. 10th Lancers, 9th Hodson's Horse, France. Wounded in Palestine, September 1918.

Shirley, G. S.

Burma.—I. A. R. O., August 1918, Burma Rifles. Recalled, February 1919.

Simeon, G. N.

Assam.—I. A. R. O., October 1915, attached 2/1st K. G. O., Gurkha Rifles. January 1917, attached 3/3rd Q. A. O. Gurkhas, Egypt, June 1917—December 1918. Attached E. E. F. Imperial School of Instruction. Recalled, March 1919.

Simmons, C. E.

Assam.—I. A. R. O., attached Supply and Transport Corps, November 1915. Mesopotamia, July 1916. Palestine, June 1918. Adjutant, 3rd Divisional Train. Mentioned in despatches. Mesopotamia, 1917. Recalled, June 1920.

Sitzler, E. A.

Burma.—I. A. R. O., July 1915, 1/9th Gurkhas. 79th Carnatic Infantry, 156th Infantry, Mesopotamia.

Smith, H. C.

Burma.—I. A. R. O., November 1917, 1/70th Burma Rifles, Egypt. Recalled, March 1919.

Sothers, D. B.

Bombay.—I. A. R. O., April 1915, attached 2nd Somerset Light Infantry, Quetta. 114th Mahrattas, July 1915. On service Mohmand Expedition, September and October 1915, and Mesopotamia, May 1916 to December 1918.

Teague, L. E. S.

Bengal.—I. A. R. O., Gurkhas, Palestine.

Thomas, A. R.

Assam.—I. A. R. O., attached S. and T. Corps, July 1916, Mesopotamia. Invalided to India, December 1917.

Trotter, H.

Burma.—I. A. R. O., November 1914, attached 1/2nd Gurkhas, Mesopotamia. Captain. Wounded, February 1917. Military Cross.

Tyndale-Biscoe, H. L.

Burma.—R. N. A. S. and R. A. F., Eastern Mediterranean. Captain.

Walden, G. P.

Burma (P. F. S.).—102nd K. E. O. Grenadier Rifles 107th Pioneers, Mesopotamia, N.-W. Frontier. Recalled, March 1919.

Walker, H. C.

Burma.—May 1918, Staff Training. Recalled, October 1918.

Walsh, A. J.

Burma (P. F. S.).—December 1917, Military Police.

Wright, F. A.

Burma (P. F. S.).—September 1916, 85th Burma Rifles. Recalled, February 1919.

Young, J. V.

Burma.—May 1918, Staff Training. Recalled, August 1918.

Godowns — Wood Preservation Plant and Boiler House — Sturtevant Seasoning Kilns

View of part of the Economic Branch, New Forest Research Institute, looking N.E.

Photos. by R. P. Dalley, I.F.S.

Seasoning Laboratory — Tiemann Seasoning Kilns — Pulp and Paper Mill

Another view of the above looking N.W.

VOLUME XLIX NUMBER 6

INDIAN FORESTER

JUNE, 1923.

A VISIT TO THE FOREST RESEARCH INSTITUTE, DEHRA DUN.

PART II.

The Example of America.—The remarks made above with regard to the possible achievements of Forest Research Work in India are not merely optimistic conjectures. In the United States (which is the most advanced country of any in the matter of Forest Utilisation) the value of Forest Research has been proved over and over again, although the Central Research Institute at Madison, known as The Forest Products Laboratory, has only been in existence since 1910. An instance has already been quoted of how investigation on the mechanical properties of American woods has given knowledge permitting a 20 per cent. increase in allowable working stresses in structural timbers, which means a possible saving of forty million dollars each year. Proper nailing

and improved box design developed by the Laboratory and adopted by the trade is estimated to save about a million dollars a year in claims for loss and damage to commodities during transit. The adoption of improved methods of turpentining developed by the Forest Service has resulted in increased yields and decreased injury to timber with net savings aggregating 4,000,000 dollars per year. In short, it was estimated that in 1920 the annual *saving* to American industries *directly* attributable to the work of the Laboratory was approximately 30 million dollars. Were full use made of the results of the Laboratory's investigations there was possibility of a very much larger saving. For instance, only 10 per cent. of the possible 40,000,000 dollars referred to above was included in the calculation of actual savings. Again, it was estimated that the *preventable* losses in commercial operations, due to improper air-drying and poor kiln-drying, aggregated annually over one billion dollars at the price of lumber in 1920. These losses are constantly growing less through the widening sphere of Laboratory influence. The following statement, quoted from a recent number of '*The Timberman*', shows another aspect of the value of Research :—'The annual consumption of timber in the U.S.A., exclusive of fuel wood, is over 50,000,000,000 board feet (almost five times the yearly growth), and approximately one-half of it is destroyed by decay. If all timber used in the U.S.A. adapted to treatment (preservative) were treated, it would decrease the drain on the forests by over 10,000,000,000 board feet per year, and still maintain existing conditions of supply and demand. No mention has been made of the extremely valuable war work which was carried out by the Laboratory.

The war brought out with startling clearness the vast importance of wood and other forest products in warfare. The demand for wood for barracks, railways, bridges, telephone and telegraph lines, docks, ships, boxes and crates, furniture and fuel far exceeded the normal peace-time demands. Wood was also required for multitudinous special war uses such as the building of aeroplanes, trucks, artillery and wagon wheels, gunstocks, handles for tools, mortar boxes, posts for entanglements and in the building of trenches. Wood pulp was not only used to a far greater extent in the making of paper, but assumed vast import-

ance in the manufacture of explosives, as a substitute for cotton dressings and in the making of textiles and clothing. The distillation product of wood play an important part in wartime. Methyl alcohol is used in the making of medicines and disinfectants, and in the manufacture of dyes and other products. Acetic acid, turpentine and resin are also greatly in demand. In connection with all these needs the Laboratory at Madison played an extremely important part. Many new investigations and urgent researches had to be carried out. The Army and Navy authorities were soon convinced of the practicability of kiln-drying material green from the saw to a condition equal to or better than air-dried stock, which very soon became exhausted. In connection with aircraft woods specially valuable work was done both in the matter of seasoning, testing and designing as well as in the discovery of suitable substitute woods. Closely associated with this work was the development of water-resistant glues. Countless other problems were solved by the Laboratory staff ; for instance, in the preparation of a specification which allowed the use of many different kinds of wood in the manufacture of boxes ; in getting over many technical difficulties connected with the building of wooden ships ; in recommending the use of zinc chloride for the preservation of sleepers in certain dry localities when there was a shortage of creosote ; in finding suitable absorbent charcoal for use in gas-masks ; in finding ways and means for producing suitable cellulose from wood for the manufacture of high explosives ; by making over 18,000 microscopic identifications of wood and charcoal ; and by examining wood, especially wood used in aircraft, for decay. A great deal of instructional work was carried out. Courses were arranged for the training of aeroplane and box inspectors. One of these men designed a new type of cartridge case box which save the Ordnance Department 50,000 dollars on the first contract, besides saving 100,000 dollars worth of cargo space. Numerous kiln operators were also trained.

From the above it will be clear that a real estimate of the value of the work done by the Laboratory since the date of its inception, 1910, cannot be made. But the operating cost of the Laboratory for the first ten years of its existence amounted only

to something under two million dollars, of which the War Period (April 6th, 1917 to November 11th, 1918) accounted for a fairly large portion. Thus if the average annual cost be put down at 200,000 dollars some idea of the direct as well as indirect gain resulting from Forest Research in America can be obtained.

The people of the U.S.A. place the very greatest stress on the importance of Forest Research, and so does the Dominion of Canada. Australia and South Africa are following suit. Though the Forest Products Laboratory at Madison is the Central Research Institute of the Forest Department in America it deals only with subjects which, at Dehra Dun, are regarded as belonging only to the Economic Branch. On Armistice Day the personnel of the Laboratory numbered 458. The summary shown below of the organisation of the controlling staff of the Laboratory will serve to give an idea of its activities. Given the same opportunities there is no reason why Dehra Dun should not develop in the same way. Compared to Madison, the New Site Scheme is merely a short step in the right direction. It possesses, however, one distinct advantage, in that all the branches of Research are concentrated in one place. In America the other branches of Research (Botanical, Silvicultural, Chemical and Entomological are carried out at the various Forestry Schools scattered all over the country.

Organisation of the Forest Products Laboratory at Madison, U.S.A.—The work of the Laboratory is divided into two main Divisions. Each Division has several Branches, Sections and Sub-Sections. The chief controlling officers, and the activities controlled by them, are given below. In addition to these officers at the Central Institute, there are field officers scattered all over the country, who co-operate with the officers at the Laboratory. The Forest Service is under the Department of Agriculture. The head of the Service is known as the Chief Forester. An Assistant Forester is placed in charge of the Branch of Research. The Laboratory is controlled by a Director, and an Assistant Director. The two Divisions of Laboratory Work are (1)

Finance, Service and Extension, and (2) Technical Industrial Research Problems. These are sub-divided as follows :—

1. *Finance Service and Extension.*

Branch.	Section.	Activities.
1 Accounts ...	...	Appointments, Time-keeping, Cost Accounting, Auditing, Disbursement.
2 Publication of Results.	...	Review, Edit, Publication, Distribution.
3. Laboratory Operation.	Computing ...	Calculations, Compilation, Summaries.
	Engineering ...	Drafting, Wood Shop, Sawmill and Yard, Machine Shop and Electrical Shop.
	Photography ...	Report Illustrations, Motion Pictures, Photographic representation of Laboratory data.
	Personnel ...	Employment, Assignment Control, Personal Welfare, Charts, Graphs and Visible Index.
	Quarters ...	Maintenance, Janitor and Watchman Service, Messenger Service, Truck Service, Property Accountability.
	Records ...	Files, Library, Mail Control, Stenography.
	Supplies ...	Procurement, Store-rooms, Warehouse, Shipping.
4. Co-ordination ...	Project Control ...	Status and Progress of Investigative Work.

2. *Technical Industrial Research Problems.*

1. Pathology ..	Co-op B. P. I. (Bureau of Plant Industry).	Methods to prevent Mould and Stain, Storage conditions of Forest Products, Resistance of Wood to decay and Wood-decaying fungi, Building Rots and their prevention, Toxicity of Preservatives.
2. Derived Products	Wood Distillation	Efficiency in Production and Utilisation of Products of Wood-distillation and Extraction.
	Wood Preservatives.	Chemical composition and physical characteristics of Wood Preservatives.
	Ethyl Alcohol ...	Ethyl Alcohol from Sawdust and Waste Sulphite Liquor, Study of the uses of Hydrolysed Sawdust.
	Cellulose Chemistry.	Chemical composition of Wood, Essential Oils, Gums and Balsams.

2. Technical Industrial Research Problems—(continued).

Branch.	Section.	Activities.
3. Pulp and Paper	Soda and Sulphate Processes.	Study of the manufacture of Pulp and Paper, Extension of the use of Wood Pulp.
	Sulphite Process...	Manufacture of Pulp and Paper by the Sulphite Process, Utilisation of Waste Bark for Tanning purposes, Suitability of Wood Pulp for the manufacture of Nitrocellulose.
	Chemistry of Pulp	Chemical properties of Commercial and Experimental Pulps obtained by various processes, including bleached Pulps.
4. Preservation ...	Moisture Proofing and Humidity Control.	Development of Moisture Resistant Coatings, Design of Apparatus for Humidity Control in Wood-working dactories
	Wood Preservation	Protection of Wooden Structures from decay, Durability of Treated and Untreated Wood, Protection of Piling from Marine Borers, Efficiency of various Wood Preservatives, Methods of treating Commercial Woods.
	Gluing Problems	Glue Strength and Durability Tests, Plywood manufacturing problems, Problems in gluing laminated Products
	Water Resistant Glues.	Development and Improvement of Water Resistant Glues, Study of Commercial Glues.
5. Timber Mechanics.	Comparison of Species.	Strength of small clear specimens. Influence of defects on strength and limitations of use
	Effect of Treatment on Strength.	Effect of Kiln drying on the strength of Woods, Effects of Steaming and Boiling Bending Stock, Effect of Preservative Treatment on Strength of Wood.
	Manufactured Articles.	Strength and Design of Manufactured Articles, Limitations and Possibilities of Splices and Laminations, Manufactured Articles using small sizes and low grades.
	Plywood ...	Standard Plywood Tests, Plywood Joints and Fastenings, Strength and Design of Plywood forms.
	Structural Timber Grading Rules.	Strength and Use of Structural Timbers, Efficiency of Various Joints and Fastenings.

2. Technical Industrial Research Problems—(concluded).

Branch.	Section.	Activities.
	Aircraft Study ...	Factors influencing stresses, strength designs and specifications of fabricated products with special reference to Airplane parts.
	Containers ..	Study of containers and Methods of Packing, Strapping of Wooden Boxes, Instruction of Industrial Representatives.
6. Industrial Investigation.	Specifications and Grades.	Standardisation of Sizes, Grades and Specifications for Lumber, Cross ties (Sleepers), Dimension Stock and other Wooden Products. Adaptation of Species to correct use.
	Industrial Utilisation of Wood.	Studies of Manufacture of Forest Products, Studies of Wood Using Industries. Economic Utilisation of Low Grade and Waste, Statistical and Industrial Study of Wood Uses.
	Dimension Stock Study.	Studies of present and most efficient methods of manufacturing and utilising lumber and small dimension stock.
	Spark Arrester Study.	Study of Spark Arresters and conditions relating to their use.
7. Fundamental Laws of drying Wood.	...	Behaviour of Wood in regard to shrinkage and swelling with moisture changes.
8. Timber Physics	Wood Technology	Determination and Description of Species, Instruction of Industrial Representatives, Relation of Structure to Properties.
	Kiln Drying ...	Study of Commercial Processes and Problems of Kiln-drying. Research in Kiln-drying and Air seasoning various Species. Physical properties affecting the Seasoning of Wood.

India contrasted with the United States.—The above description of the organisation of America's Research Institute shows what an excellent example India has before her if she chooses to develop the Economic Branch of her Research Institute along commercial lines. There is no question about it that, *unless Forest Research is developed as fast as it can possibly be developed*, very little industrial and commercial progress can be made in those industries, and works of improvement and extension which are dependent in

some way on the products of our Forests. By contrast the proposed organisation at Dehra Dun pales into insignificance when compared with that of America. And when it is remembered that India possesses more than ten times the number of commercial timbers that America does, and that the forests of America are mostly privately exploited (to the extent of 97 per cent.), the contrast is even more striking. In India the onus of development and extraction rests almost entirely upon the Forest Department. In America the Forest Department is concerned far more with conservation than exploitation. The need for conservation is very acute for the annual 'cut' is estimated to be quite five times the annual 'yield.' The activities of the Central Research Laboratory are largely concerned with the finding of uses for the less well-known species, and with enquiries into the best methods of prolonging the normal lives of various timbers by means of Seasoning and Preservation. In India a great deal of additional work has to be undertaken by the Forest Department in connection with Logging Schemes, Improved Methods of Transport, and with the Conversion, Storage and Disposal of Timber and other Forest Products. Yet, in spite of the fact that the Forest Department in India has so much more actual commercial work to do than the Forest Department in America, the contact which exists between the Research Institute at Dehra Dun and the commercial world is nothing compared to the ties which exist between commercial life in America and the Laboratory at Madison. In India even the Forest Department knows very little of what is happening at Dehra Dun; the want of co-ordination between Research Officers at Dehra Dun and Forest Officers in the Provinces is most marked. Even in the Provinces we find Circles and Divisions working quite independently of each other. The appointment of Chief Conservators, and of Special Officers to control and co-ordinate work in connection with Silviculture, Working Plans, Utilisation and Research is helping to put matters on a better footing in some Provinces.

The Forest Department must lead the way.—The question naturally arises: 'How best can the Forest Resources of the

country be developed?' The answer is, in one respect, obvious: 'The Forest Department must rise to the occasion and seize the glorious opportunity which it undoubtedly has of capturing completely the Indian Timber Market, and of obtaining a sound and ever-increasing foothold in foreign markets for Indian Forest Products.' The importance of Regeneration, Silviculture and Protection is probably fully realised by every Forest Officer. The importance of the commercial side of the duties of the Department is realised only in a very vague sort of way. The Finance Department are still more hazy in this connection. The public probably realise better the extent to which the Forest Department is lacking in business ability, but they cannot have the slightest idea how matters can be improved. The Forest Department must work out its own salvation, not merely by finding the solution to the problem, but by getting both Government and the public to see and grasp the solution. The Forest Department must lead the way and see to it that the slender link, which at present exists between the producers and consumers of timber in India, is forged into a mighty chain. In other words, the Forest Department must see to it that the Economic Branch at the Central Research Institute, and the Utilisation and Working Plans Branches in the Provinces are so developed and strengthened that they will always be in a position, not merely to perform routine duties, but also to act like commercial agents in the matter of forcing upon public attention the value of the enormous wealth of which the Department is the custodian. Government do not, and the general public cannot, realise the extent to which Indian Forest Products should play a part in the life and work of the Empire. This is natural, so it is up to the Forest Department to educate them in the matter. What is required is a clear presentation of hard facts; the rest is bound to follow. The mere publication of Forest Records and Bulletins is not sufficient. They are often not even read by Officers of the Department. It is recognised by the Inspector-General and the officers at the Research Institute that propaganda work by Research Officers, in the shape of popular lectures, illustrated by lantern slides, and popular articles in newspapers and periodicals, is very essential if the Department, and parti-

cularly the Research Institute, are to be brought into close ouch with the commercial and industrial world, and if Government is to be won over to the point of view that money spent on the strengthening of the Department, especially in connection with Research, will bring in a handsome and speedy return.

The Importance of the Economic Branch at Dehra Dun.—If the Forest Department is to perform the duties referred to above, the first thing that it has to see to is that it has the necessary organisation and equipment to enable it to produce the hard facts required for the purpose of capturing public opinion, and of gaining the confidence of the Indian Legislatures. The New Site Scheme is a concrete example of what has already been effected in this direction. The Provinces can also furnish concrete examples, for instance the United Provinces at Clutterbuckganj and Burma at Rangoon. These places may be said to contain monuments of the imagination which has been displayed by various Forest Officers, and of the confidence which Government has, in the past, placed in their aspirations. It is earnestly hoped that the Economic Branch at least will not be made to curtail its programme owing to financial stringency. It will be chiefly in this Branch that the hard facts required in connection with the development of the Forest Resources of the country will be produced. To produce facts of value to the commercial world Research will have to be conducted on a commercial basis as far as possible, and not simply on a small laboratory scale as heretofore, some idea as to quantities, working costs and working conditions on a commercial basis must be obtained if any real progress is to be made. Nothing will advertise Forest Products better than the fact that the Forest Department can actually demonstrate commercial methods and processes, and can give reliable information as to the financial results that are likely to accrue from any particular undertaking. The trouble at present is very largely that neither Government nor Commercial Firms will undertake anything new which involves any risk of not bringing in a substantial profit.

Curtailment of the Economic Branch will mean a very serious set-back to the Development of Indian Forest Resources.—Once

the public become sufficiently aware of the value of the work that is being carried out at Dehra Dun, it is certain that the number of inquiries and the number of visitors to the Dehra Dun will increase very considerably. If the existing staff is not sufficiently expanded from time to time, in anticipation of this increase of work, one of two things is bound to result. Either the Investigative and Research Work will have to go by the board, or else enquiries will not be replied to in a prompt and businesslike manner. Either result will cause a serious set-back to the work of Development as a whole, and the public will once again be disappointed by the unbusinesslike methods which are so characteristic of all Government Departments. It would be infinitely better if the Research Institute, and the Department generally, refrained from doing much propaganda work (except in the Department itself and amongst the Controlling Executive and Financial Authorities), until it was certain that sufficient staff and equipment were forthcoming to deal with the situation that is likely to arise if much popular propaganda work is undertaken.

Development of the Working Plans and Utilisation Branches in the Provinces.—Side by side with the pushing of the New Site Scheme must come the extension of the Working Plans and Utilisation Branches of the various Provinces. The shortage of officers, which was a natural result of the War, had the effect of depleting both these Branches to such an extent that in many Provinces they ceased to exist, if they had ever been formed. Without a strong Working Plans Branch the surveys of Forest Resources (which are extremely important from a commercial point of view) cannot possibly be carried out with any sort of accuracy. The situation and extent of fellings, the lines of export, the adjustment of privileges, etc., are important commercial considerations in a felling scheme. The considerations have to be extremely carefully worked out by the Working Plans Officer, unless he wants his work to be scrapped after a season or two. From a commercial point of view, the Utilisation Branch comes in where the Working Plans Branch and the Territorial Branch leave off. It is essentially the Commercial Branch of the Department. In addition to the work of providing a connecting link

between the Forest Department and the Trade, the Utilisation Branch is called upon to control large Departmental felling extraction and conversion schemes. It also co-operated with the Economic Branch at Dehra Dun in helping to carry out investigations in the Forest in connection with Research problems. Territorial Forest Officers cannot possibly attend to the commercial side of forest work without neglecting their other duties, unless they happen to be in Division of small commercial importance.

A weak Utilisation Branch means a very badly served public.—There can be no doubt about the statement that the general public is, at present, badly served by the Forest Department. This is due primarily to the shortage of officers, but also to the want of specialised training in Utilisation subjects and in business matters amongst Forest Officers generally. The fact that more than ten per cent. of the sleepers used in this country are imported from America and Australia, and that the use of steel and concrete sleepers is largely on the increase is evidence of the general state of affairs as regards the use of timber in India. There are two chief reasons why this is the case, when there are cheaper and better Indian timbers available for sleepers, not to mention for other purposes for which foreign timbers are imported, *e.g.*, Oregon Pine for large squares, Maple for flooring and Australian timbers for constructional purposes. One reason is that the public is on the whole, ignorant of the kinds, qualities, quantities and prices of available Indian timbers, and of the localities where these timbers can best be obtained. The other reason is a much more serious one. It is, that it generally happens that, if an enterprising person happens to want a certain Indian timber of which he has heard, he finds that he cannot get it in the way in which he wants it. Timber dealers usually only stock the few species that are naturally immune from white ant attack. Thus the required species must be freshly felled. This means endless delay. Moreover, even if the extraction and conversion have been speeded up, there will be much further delay in connection with the seasoning and possibly the preservative treatment. In the end the enthusiast, who tries to make

use of an unknown or little known species, finishes up with buying what he can easily get, no matter whether it costs him more, or whether the timber is American or Indian. This is where the Utilisation Branch is required for the purpose of carrying out pioneer work in connection with the extraction, conversion, seasoning and preservation of less well known species, in the manner indicated by the Research Branch. Thus it all comes back to this that, unless the Forest Department is better staffed and better equipped, the commercial development of the Forest Products of India will not be possible.

The difference between Commercial Research and Commercial Business.—It must be strongly emphasised, in connection with what has been said above, that the Research Branch does not in the least contemplate setting up Forest Products businesses at Dehra Dun or other Research Stations. There is not the slightest intention that the Saw Mill should turn out sawn wood for sale, or that the Paper Mill should work at a profit, or that the Seasoning Kilns should season timbers very cheaply. Direct profits will be out of the question, where the raw material will come from all over India in the shape of samples many of which will be used for purely experimental purposes, and will never reach the finished stage. Furthermore, most of the plant and fittings are too complicated and too expensive to be of any direct commercial benefit. The extra fittings and controls (*e. g.*, automatic controls) are absolutely necessary from a Research point of view, but would be omitted in a commercial plant.

R. P. DALLEY, I.F.S.

GROWTH IN TREES.

It is only within recent years that scientific investigation has been started with regard to the actual daily and seasonal variations in the growth of trees. Dendrographic experiments form a study of absorbing interest and, although such experiments have never been attempted (to the writers' knowledge) in India, the subject is one which must interest Forest officers in all parts of the globe.

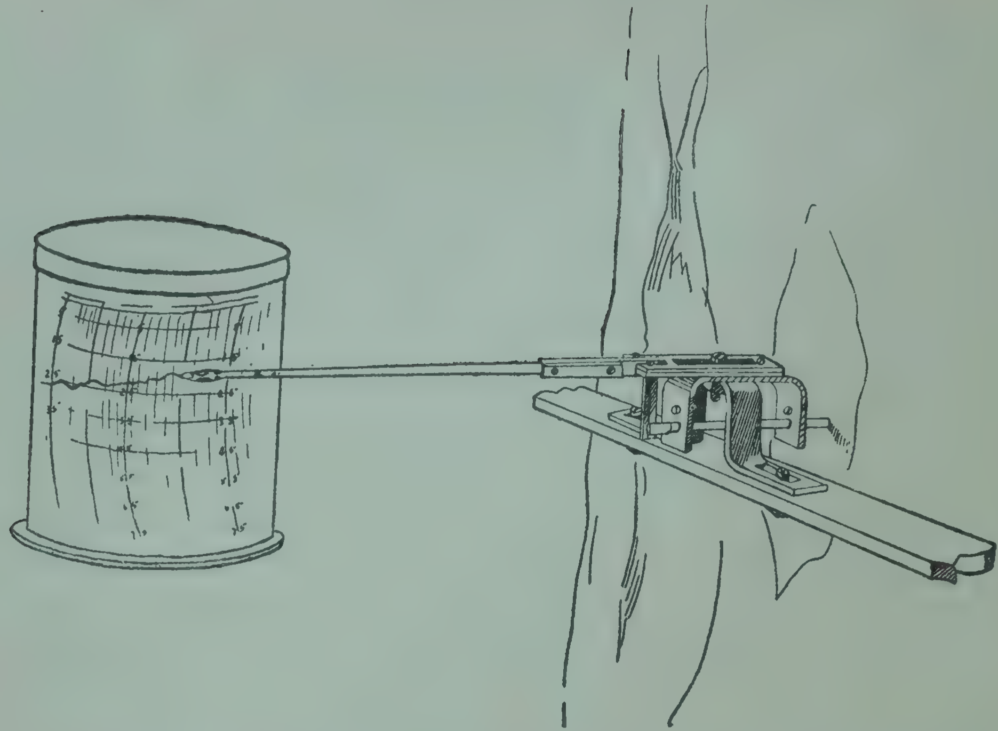
Such results as have been obtained up to date come from America and for these results the science world is indebted to Dr. D. T. MacDcugal who has devoted a great deal of time in the last few years to the study of the daily and seasonal changes in the volumes of standing tree trunks and to the construction of various instruments for accurately recording these changes. The object of this article is to give a brief account of his investigations and some of the more interesting conclusions he was able to draw from those investigations.

To those who hanker after definitions, a tree may be defined as a tall cone of wood terminating in leafy expanses. The base of the cone is sub-divided into myriads of rootlets, through the surface of which, soil solutions enter the tree system and the water passing up through the trunk and branches, is transpired from the leaves. The actual trunk of a tree is composed largely of dead cells, but enclosing it is a thin sheet of spindle form cells known as the cambium cells, which, in the growing season, enlarge in thickness and divide lengthwise, thereby increasing the girth of the tree to an infinitessimal degree with each successive enlargement. External to the cambium layer are sieve cells, bast fibre, cork cells, etc., and the whole is enclosed in the bark which varies widely in structure in different species.

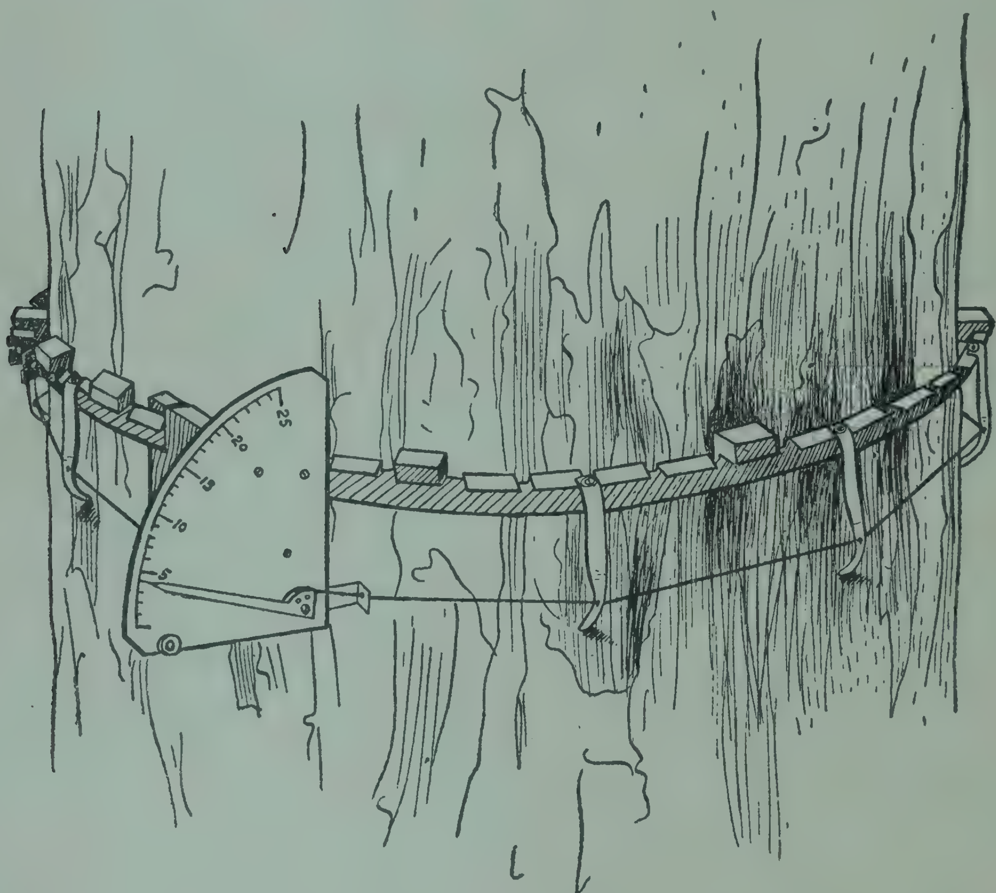
As already mentioned, the greatest amount of increase or change in volume is that which results from the multiplication of the cambium cells. The colloids of these cells are practically never in a stable condition but are always adjusting themselves to an ever changing environment, more especially with regard to the water they contain. All plants, except submerged forms, are continually losing water from part of their surfaces while at the same time, water is entering the system through the absorbing surface of the roots, and as a consequence the volume of the tree increases or decreases according to the balance between gain and loss.

These changes in the hydration of the protoplasm in the cells results in the conversion of the materials in the cell sap into the condition characteristic of living matter.

Both processes, the one of absorption and the other a shifting of equilibra in chemical composition cause an increase of the



Improved dendrograph lever set. The inner end of the quartz rod rests on a prepared surface of the bark. Any movement of this rod is at once recorded on the revolving drum.



One form of the dendrometer. A slight enlargement has taken place causing the flexible arms to be pressed outward. This has pulled on the wire to such an extent as to cause the indicator point to move from zero at the bottom of the scale to "4."

volume of the protoplasm and an enlargement of the cell-mass of which it forms a part. This is what is commonly known as growth.

Now any measurement of the increase or variations due to growth in the cambium layer will at the same time include the variations in the volume of the woody cylinder which is also the conduit through which liquid passes from the roots to the crown. Such trees as the birch, with 200,000 leaves, are reputed to transpire as much as 400 litres in a single day. The trunk of a tree may, in fact, be compared to the supply hose of a fire engine coupled to a hydrant. When the pressure from the mains is enough to supply water faster than it can be pumped out, the hose is distended. When the engine tends to take water faster than it is delivered by the hydrant, the hose becomes deflated. In the case of trees, however, the conduit is not a simple pipe or a set of pipes, but is made up of a series of vessels through which the water passes under capillary action and which may be only partially filled with water so that when water is withdrawn from such a system faster than it is taken in, the resulting changes are very complex in character. These facts were well considered by Dr. MacDougal when he instigated his experiments in the measurement of growth in trees in 1918 and a new technique with specially designed instruments was found necessary for the analytical study of the changes in volume of these massive organs. Such instruments were designed and afterwards improved on by the investigator and include:—

1. *THE DENDROGRAPH,* which is an instrument for making continuous records of the variations of tree trunks. The essential feature of this instrument consist of a floating frame of metal of low temperature coefficient which is placed round the tree trunk, and the variation in distance between a contact rod on one side of the trunk, and of one end of a rod on the other side, is traced by a pen on the free end of a lever, on a sheet of paper carried on a revolving cylinder.

Such measurements are in terms of the diameter. The illustration will give a general idea of the form this instrument takes.

A DENDROMETER, which is an instrument of simple design and non-expensive construction which is placed round the trunk of a tree and the size of the trunk read on a dial from time to time. The essential parts of this instrument are an encircling wire engaged with a number of bearing levers. One end of the wire is anchored and the other is attached to the short end of a lever, the free end of which moves over a scale giving readings of the size of the trunk, in terms of several radii or of the circumference.

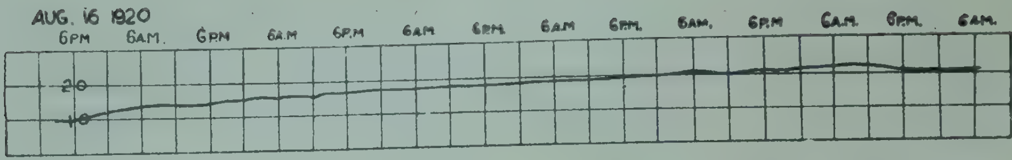
It is not proposed in an article of this nature to go into lengthy details and descriptions of the methods of using these instruments but merely to give a short account of the work done up to date and of the extraordinarily interesting facts which have come to light.

1. In the first place, the period in which enlargement of trunks takes place has been proved to be comparatively brief, even in places where the season is of indeterminate length.

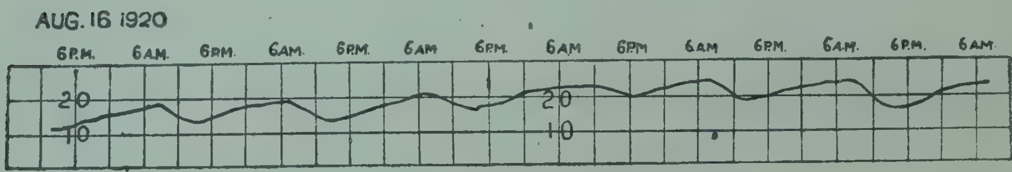
2. The trunks of all trees measured, show a daily variation in size, by which the maximum is reached shortly after sunrise and the minimum at a time after noon, dependent on external agencies. These variations appear to depend upon the water balance in the woody cylinder and are greatest in the seasons in which water loss from the crown is greatest and least in the cooler and damper seasons.

Measurements of variations in the woody cylinder are made by boring holes through the wood of the last two years, and arranging the contact rod of the dendrograph to bear on the wood formed two years previously.

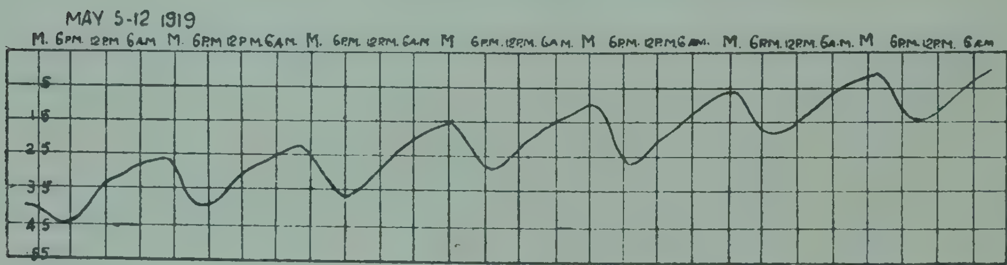
3. Growth in the terminal buds with the resultant elongation of leaders and branches begins in many trees some time before enlargement of the trunk takes place. The period separating the two may be no more than a week, as with *Quercus agrifolia*, but has been recorded to be as much as 10 or 12 weeks in the case *Pinus radiata*. In certain rare cases, more especially with the Parry Spruce (*Picea Parryana*) and Douglas Fir (*Pseudotsuga Douglasii*), the trunks were enlarging at a time when the buds were in a very early stage of development. In the single case in which



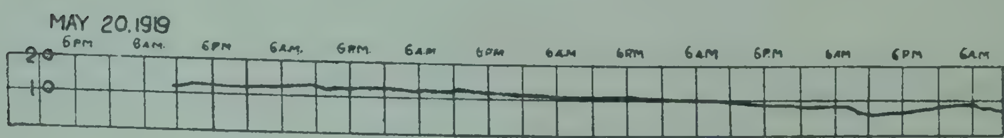
Dendrographic record of a California oak, showing a steady increase denoting growth, with practically no daily variations.



Dendrographic record of the variations in growth of a Monterey pine. Note the daily variations giving a wavy effect, but at the same time there is a steady increase in actual growth.



Dendrographic record of an ash tree, showing maximum daily variations, due to low relative humidity and high transpiration during the mid-day period. At the same time there is a steady increase in actual growth.



Dendrographic record of a pine tree, showing a gradual but distinct *decrease* in growth due to very hot dry weather.

dendrographs were attached to a pine tree simultaneously at one metre and 8 metres from the ground, growth began coincidentally at the two places in 1920, but in the following year enlargement at the higher point commenced a few days before any action near the ground had begun.

4. Daily variations in the diameter of a trunk which has ceased to grow for the season amount to one part in 1750. That a large share of this variation is due to changes in the hydration of the living cells is proved by the fact that in the woody cylinder of the trunk internal to the growing layer, the variation drops to 1 part in 8,750 of the diameter.

5. The actual daily change in volume calculated on the basis of a conical trunk 18 metres high and 35 cm. in diameter at the base amounts to 400 cub. cm.

The greatest daily equalising variations were shown by *Fraxinus, Pinus, Picea* and *Juglans.*

Smaller variations were displayed by *Populus Platanus*, *Fagus, Quercus* and *Citrus*. No available facts furnish the basis of an adequate explanation of such differences.

6. The final effect of rainfall shown within a few hours is to accelerate growth, but it has been repeatedly observed that actual shrinkage may take place while the rain is falling.

7. Irrigation of the soil round the roots of a pine tree when the moisture contents of the soil was less than 6 per cent. was followed by progressive enlargement at the base of the tree and at a point 8 metres higher, within 24 hours. The distance from the absorbing surfaces of the roots was not less than 3 metres from the lower instrument and 11 metres from the upper instrument. It seems hardly credible that the water could have conducted through the complicated series of cells in the roots and trunk in so short a time.

Nevertheless results obtained in a similar irrigation test with oaks were even more startling. *Within two hours*, the dendrograph which was in contact with the trunk at a distance of at least 3 metres from the absorbing surfaces of the roots showed a steady enlargement. This action may be directly connected with the fact that vessels in these oaks were numerous and large

Such rapid enlargement is nevertheless almost unbelievable but the dendrographic records leave no room for doubt.

Such then are the main points of interest as shown by the highly sensitive instruments used in these experiments.

Space does not allow a full and detailed account of the progress of all the experiments during the actual period of measurement but it is hoped that the illustrations will explain matters for themselves. The four dendrograph records shown were picked out of many, as typical of the variety of the form they assume and as showing the normal as well as the extremes in the daily variations. The above remarks are not based on the measurement of a few isolated trees but from the well-considered conclusions arrived at after several years of investigation with hundreds of species in different parts of America.

Conifers and broad-leaved species both came in for their full share but no startling differences are recorded in the results obtained from these two sections. The readiness of reaction of the broad-leaved species to an increase of soil water-supply, and the shorter period of enlargement, and small relative total of these species, were however generally noticeable.

Such then are the results of these investigations to date. The description is of necessity very brief and inadequate, and those who are interested in this subject, and who would like to study the subject in detail, should refer to the pamphlet published by the Carnegie Institution of Washington and entitled "Growth in Trees," by Dr. D. T. MacDougal.

H. TROTTER, I.F.S.

[The following note has been added by Dr. H. P. Brown, Ph.D., the eminent American authority on wood technology, at present officer-in-charge, Wood Technological Section, Forest Research Institute, Dehra Dun, in order to bring out one or two points of interest.—HON. ED.]

Dr. MacDougal's paper on tree growth is of more than ordinary interest, coming as it has as a sequel to certain histological studies in this field which were conducted at Ithaca, N.Y., during 1910—14, inclusive, mention of which is made in his paper, and which are now being continued at the New York State

College of Forestry, Syracuse, N.Y. A brief discussion of the results achieved in this latest contribution to the subject may not be out of place.

It would seem, that the argument as to seasonal rhythmic growth in trees has been finally settled as cambial activity, appears to be governed purely by environmental factors prevailing at a given period which enhance, inhibit, or preclude growth altogether. A tree enlarges only when conditions permit of it, irrespective of the time of year; nor do the growth periods of successive years necessarily overlap. There is no inherited tendency toward dormancy and activation of the cambium at specified times, and the problem is rendered the simpler thereby since growth dynamics can be reduced to understandable physical terms and the mysterious and unexplainable eliminated altogether.

The dendrograph had likewise established the presence of diurnal growth pulsations, which attain a maximum in the early morning and a minimum at mid-day, or in the early afternoon, when the temperature of the trunk is at the highest. This apparent anomaly is to be explained in that the water absorption by deep roots is little or at all inhibited by the cooler temperatures of the night hours, while the transpiration rate is altered markedly thereby. The meristematic tissues become fluxed with water at night, a condition which is relieved by ensuing transpiration the following day. If this reasoning is correct, it follows that water plays a more important rôle in tree growth than temperature; owing to the insulating property of the bark, night temperatures are not such as to inhibit growth materially; it is retarded during the higher readings of mid-day, not from excess of heat but through reduction in available water.

It is to be noted in the above connection that pulsations may occur without permanent increment, in which case the daily maxima and minima wholly compensate each other. Or actual shrinkage may take place over a given period and the apparent gain of a preceding cycle be thus wholly negated. Finally, some trees exhibit no seasonal growth whatsoever for a given year a condition which sets at naught the method of estimating

the age of trees through ring counts at the base. Where actual gain is registered by the dendrograph I would caution the reader in interpreting it wholly in terms of wood increment. Of necessity in measuring growth by cell division, the arms of the instrument must be set without the last formed periderm owing to the desiccation of the deeper lying, living tissues which would otherwise ensue. The gains registered represent not only the product of the activity of the true cambium, that is, the new xylem and phloem, but the cork cambium as well in terms of additional periderm. Different tree species vary greatly in the manner, extent and rapidity of periderm formation; in addition the wound stimulus arising through the removal of the outer bark would undoubtedly result in an increase in the number of cork cells where the last formed periderm was exposed. It would seem desirable in some instances at least to correlate the dendrograph readings with accurate histological studies; measurements of increment borings can scarcely replace these in making accurate deductions.

The fluctuations which occur when the dendrograph is set directly on the wood itself can only be explained in that the moisture content of the woody tissue or portions of it falls below the fibre saturation point at times during the twenty-four hours. The author suggests that the water thus lost is withdrawn from the wood either by direct outward exit through the bark, a condition which seemingly takes no account of the imperviousness of the cork to the passage of water, or upward through the branches and out through the leaves, possibly in both ways. It is inconceivable to consider that the volume of a lignified tissue is influenced by a loss in turgescence of such living cells as it contains (wood ray and vertical parenchyma in the sapwood), cells, the walls of which are more or less lignified and surrounded by thick-walled, strongly lignified prosenchymatous tissue, nor can the presence of air bubbles in dead lignified cells (prosenchyma), though their surface tension varies with changes in the amount of water in the tissue, have any appreciable bearing on shrinkage. I am of the opinion that the diurnal pulsations registered in the wood itself are traceable to varying moisture content in prosen-

chymatous cells (which die and lose their content the season of their formation) when the water in the walls of such mechanical elements falls below the fibre saturation point, shrinkage takes place, even though the neighbouring living parenchymatous tissue in the sapwood is still fluxed with water. The irregular distribution of moisture in the last formed annual layers would explain the phenomenon of shrinkage in the wood body proper.

The recent contribution of Dr. MacDougal works a distinct advance in a field of research fraught with many obstacles, some well nigh insuperable. His results are timely when correlated with those obtained from histological studies, supplying as they do many links of information which assist materially in the marshalling of the scientific data in this immediate field. In a country such as India with wide fluctuations in temperature and rainfall, with a range of tree species second to none in the world, the proper understanding and interpretation of tree growth would play no small part in the silvicultural practice of the future. There is a dearth of information on the growth of Indian trees, and it is desirable that growth studies be instigated in the near future to supply the much-needed information.

H. P. BROWN, PH.D.

THE EFFECT OF WIDE SPACING IN TEAK PLANTATIONS.

In view of the recent correspondence in the *Indian Forester* on the subject of spacing in teak plantations the following note may be of interest:—

In the course of recent sample plot work I was able to compare a plot originally planted 9′ × 9′ in 1914 (now 9 years old) with a plot originally planted 6′ × 6′ in the same year.

The following points are of interest :—

Forking.—Approximately 19·25 per cent. of the stems in the 9′ × 9′ plantation were forked as compared with 6·5 per cent. in the 6′ × 6′ plantation. This made the thinning in the 9′ × 9′ plantation extremely difficult owing to the large number of forked trees and the greater importance of each tree in the general stocking. In the 6′ × 6′ plantation, owing to the closer

stocking, forked trees could almost without exception be cut out in the ordinary course of thinnings without causing any unevenness of stocking.

Growth. (a) *Height*.—The height growth of the sample trees taken in the 2 plots compares as follows :—

Diameter Inch Classes.	Height.	
	6′ × 6′	9′ × 9′
4″	41·5	40·9
5″	47	44·8
6″	51	48
7″	53·7	50·9
8″	...	53·1

(b) *Diameter*.—The stems in each plot were classified as follows :—

Diameter Inch Classes.	Percentage of stems.	
	6′ × 6′	9′ × 9′
3″	11·4	5
4″	38·5	23
5″	33·5	35
6″	13·6	25·5
7″	2·75	9·8
8″	0·25	1·7
	100	100

This shows that the diameter increment of individual stems in the 9′ × 9′ plantation has been greater than in the 6′ × 6′ plantation while the height growth of dominant trees is much the same. At the same time it should be remembered that according to our latest ideas, the 6′ × 6′ plantation should have been thinned 3 years ago at the age of 6, and had this been

done there can be little doubt that there would not have been much, if anything, in favour of the $9' \times 9'$ stocking.

Summary.—The tendency to forking in the wider spacing more than conteracts the slight increase in diameter increment which may possibly be claimed for the $9' \times 9'$ plantation. Of course these figures are insufficient to establish any theory, but they tend to confirm in a most striking manner the opinion expressed by Mr. Bourne in his Working Plan for Nilambur. On page 53 of Vol. I of that Working Plan, Mr. Bourne summarises the case for close planting. He concludes as follows:—

"The close spacing of $6\frac{1}{2}' \times 6\frac{1}{2}'$ and $6' \times 6'$, adopted in the past, resulted in such straight undivided stem, that it should be departed from in the future, only for silvicultural, and not economical reasons. Such economy may well prove to be false economy in the end." In view of the tendency towards a wider spacing which exists now in Burma, I emphatically agree with this opinion.

H. R. BLANFORD, I.F.S.

REPORT ON KARAI (*STERCULIA URENS*) TAPPING.

GUGAMAL RANGE, MELGHAT DIVISION, C. P.

It was desired to collect one maund of gum *karaiya* for which purpose an area in the vicinity of Koha Forest Village having sufficient number of the desired trees was selected. The experimental tapping of *karai* trees was started from 19th January, 1922, and completed on 30th January, 1922. Only two methods of tapping were tried as described below:—

1st Method.—In this case the bark of the tree was cut out and wood exposed with the help of 2 chisels made especially for the purpose. This is divided into 4 classes according to the shape of the notch as shown in the marginal sketches below:—

CLASS I.—One $18'' \times 4''$ notch, $2'$ above the ground and only on one side of the trees.

CLASS II.—4 oblong notches. One on each side of the tree and extending over about one-quarter of its girth. Lowest notch being $2'$ above the ground.

CLASS III.—One notch, on one side only, 3′ above the ground.

CLASS IV.—A 6′ wide band of the bark removed from all sides, *i.e.*, a light girdling.

2. The second method was to wound the tree. The wounds were inflicted at a short distance apart with a sharp pick point as suggested in the Chief Conservator of Forests' letter. Trees tapped under this method are put under Class V for the purposes of description and record.

The work was done by coolies engaged on a daily wage of Re. 0-5-0 and the total cost of the experiment amounts to Rs. 69-6-0 as detailed below:—

	Rs.	a.	p.
Cost of 2 chisels made locally	2	0	0
Cooly wages	65	0	0
Carriage of gum from Koha to Chikalda ...	2	6	0
Total ...	69	6	0

This amount does not include the cost of supervision. A statement was made which gives the full details of the trees tapped and gum obtained. An abstract taken out from this statement is given below:—

Class.	No. of trees tapped.	Gum obtained in tolas.	Average per tree in tolas
I	40	907	22
II	30	861	29
III	30	391	13
IV	60	1,661	28
V	50	843	17
Total ...	210	4,663	

It would appear from this that Classes II & IV have given best results, but whether they are detrimental to the growth of

trees or not, is yet to be seen, and if the trees do not lose their vitality after the rains are over, then, both of these are suitable methods for tapping *karai*. They give big fine clods of white gum, which will essentially enhance the quality of *katira* and its value, besides a further advantage of easy collection. In trying these methods the following points will be found useful :—

(*a*) The bark should be given a straight clean cut which can be done easily with chisels.

(*b*) The gum should be removed after it has dried fully; or else some of it will stick on to the cut surface of the edge, and, unless shaved off, will stop the passage of further tears. If, however, there may not be enough time to allow the gum to dry, then the edges must be renewed, after each collection, which can be done economically, by cutting off a thin slice of the bark edgewise along with the gum at the time of its collection. This edging will not only keep the passage of further tears clear, but will also stimulate their rush out.

CLASS V. is a good method for such cases only as would shoot out continuous tears profusely. Since it is noticed, that intermittent tears, with a slow rush, dry before the dropping is commenced, the mouth of the wound thereby gets clogged, and the passage of further tears is blocked once for all.

The gum in this case is not as white as in the preceding two cases, and its collection also is by no means easier.

The following are further observations, made during the course of this experiment :—

(*i*) Trees situated on northern or eastern slopes give more gum than those situated on the southern or western slopes.

(*ii*) Notches cut out on the northern or eastern sides of the tree give better results than those on the other two sides.

(*iii*) Trees growing on loam or alluvial soils give more gum than those on rocky or precipitous slopes.

(*iv*) Trees in shady places exude more gum than those standing in the open.

(*v*) If wet or fresh gum is collected it loses about 15 per cent. of its weight in drying.

(*vi*) Collection should not be done too often and too early after the tapping, as this simply adds to the cost, at least a month's time should be allowed, before the first collection is made, for the gum to trickle out and dry properly. Subsequent collections may be made once a month.

About 58½ seers of gum were collected out of this, about 8 seers of weight were lost in drying, while about ½ a seer was lost in weighing, storing and carrying. The cost of the experiments amounted to Rs. 69-6-0 for the yield of 50 seers of gum, and the average cost per seer came to Re. 1-6-4. The cost would have been much cheaper but for the pressure of time, and also for the reason that the trees were scattered far apart.

Fifty seers of gum were sent up instead of 40 seers. These extra ten seers were collected under the then D. F. O., Mr. R. T. Jenkin, I.F.S., orders were given to compensate the weight of bark and wood chips that were mixed with it: with the exception of this admixture, which could not be avoided for want of proper collecting knives, the gum is quite pure and dry.

N. B.—The trees tapped under Classes II & IV have neither lost their vitality, nor suffered in any way. Wounds caused by the notches are healing up.

MD. ABDUS SALAM,
Forest Range Officer, Gugamal Range.

PRIZE-DAY AT THE FOREST RESEARCH INSTITUTE AND COLLEGE, DEHRA DUN.

The annual prize distribution of the Provincial Service and Ranger classes was held in the grounds of the Forest College on March 26th, 1923.

THE HON'BLE MR. CHUNNILAL MEHTA.

On this occasion the Hon'ble Mr. Chunilal Mehta, Minister for Forests and Excise, Bombay Presidency, who had come to Dehra Dun on a visit, to see the Forest Research Institute and

College, and also Mr. P. H. Clutterbuck, C.I.E., C.B.E., V.D., Inspector-General of Forests, were present and addressed the students. Mr. Perrée, President of the Research Institute and College, opened the proceedings with his report on the work of the students during the year.

MR. CLUTTERBUCK, LADIES AND GENTLEMEN,—

The following brief report analyses the work and result of the classes who have now completed their period of training:—

The Provincial class opened in April, 1921, with 22 students. It was unfortunately necessary to remove two for incapacity during the first year, and the class therefore closed with 20 students. With the exception of one student, who contracted enteric fever and was therefore unable to complete his working plan in the field, all have attended the full course.

In order to qualify for a pass certificate a student is required to obtain a minimum of 60 per cent. in each of the major subjects of Forestry, Botany, Surveying and Engineering and 60 per cent. in the total number of marks. For Honours 70 per cent. is required in major subjects and 80 per cent. in the total. All have qualified in totals and Forestry, but it has been necessary, again on this occasion, as was the case last year, to exercise my prerogative and to help six students with grace marks in Engineering. In the minor subjects, comprising Zoology, Physical Science, Geology and Law, the work as a whole cannot be said to have been altogether satisfactory.

The insect collections have been in some cases carelessly and in others actually improperly prepared. It would be preferable to omit unknown information rather than invent it. In Chemistry, only those who had attained a certain standard prior to admission were able to qualify. We have no means of teaching chemistry and the results are the natural outcome of our present policy. As I shall explain later we are endeavouring to remove the present disabilities under which we suffer in this respect.

The practical work of the class was carried out in the forests of the Chakrata and Dehra Dun Divisions during the first year. In the second year the students again worked in the Dehra Dun Division and concluded with a tour in the forests of Northern Bengal. Short visits were paid to Bareilly and Clutterbuckganj

and to the afforestation work in Etawah. From a perusal of the working plans, and of the final papers and also from my own interpretation of the oral examination in Silviculture, the class appears to have made good use of its opportunities in studying the basic principles of silviculture, and also those problems which now confront the practical forester in the conversion of irregular to regular forests. The limitation of the regeneration work in Northern Bengal to that amount which can be successfully accomplished, forms a valuable object lesson in thoroughness and accurate silvicultural practice. The students have all appreciated the important points.

The teak forests of Malabar, which are the nearest approach in India to regular forests could not again be visited this year owing to the damages to communications and buildings caused in the Moplah rebellion.

The class on the whole may be judged as closely analogous to last year's. We have again one student who has attained honours, and the rest have been awarded pass certificates.

The Ranger class mustered 40 students at the outset, unfortunately eight had fallen so far behind during the first year as to preclude their retention, so the class ended with 32.

The qualifications for a Higher Standard Certificate require a minimum of 50 per cent. each in Forestry, Botany, Surveying and Engineering, and 60 per cent. of the total, while Honours require the same minima with a total of 75 per cent. of the maxima. For the Lower Standard Certificate the same minimum in Forestry only is prescribed with a reduction to 45 per cent. in totals.

It is, therefore, relatively rare that a student who qualifies in his first year fails to reach the last category.

During the early part of the course the results were somewhat disappointing, but the work of this class during its second year has show nconsiderable improvement. The warning issued on this occasion last year in regard to examinations has borne some fruit and the answers have borne a closer relation to the questions. I must, however, reiterate the warning then issued as there is still a tendency to write at length on irrelevant points. It has been necessary to authorise examiners to deduct up to 10 per cent.

of the marks allotted to any paper for untidiness and bad handwriting. In practical work an attempt is being made to understand and apply main principles correctly, but it must be admitted that the present is a difficult time for ranger students, who have to apply new methods and theories in irregular natural forests, and some confusion is perhaps inevitable. A desire to learn, coupled with keen observation, must form the main equipment of the practical forester, and if we have succeeded, which I hope we have, in developing habits of careful observation and the avoidance of hasty conclusions, I feel that we have gone a long way in preparing probationers for our executive staff, whose responsibilities and duties are steadily increasing in importance.

The results of the examinations prove that the class is well up to the average of the last few years. We have six students who have attained honours, 23 have higher standard certificates and three have lower standard certificates.

The practical work was done in the hill forests of Kumaon and of the Dun, during the first year ; and again in the Dun and in the Ramnagar Division during the second year.

I shall now deal with matters of general interest and which are common to both classes.

The Examiner in Surveying, kindly lent by the Thomason College, Roorkee, has reported a marked improvement in the Provincial class both in the written paper and in the handling of instruments. The Rangers, on the other hand, suffered by comparison, not so much perhaps in the written paper, as in lack of smartness and decision in the use of instruments.

In conduct and discipline both classes have maintained a good standard but I regret to have to report the expulsion of two Junior Ranger students during this month for cribbing. The consequences are well known and those who are prepared to take the risk must be equally prepared to accept the consequences. I feel so deeply in this matter, which is an indelible blot on our record, that I must again appeal to the students themselves to help me in suppressing a practice which the severest penalty has failed to stop. It may be that public opinion within the College, will succeed, where disciplinary measures have failed.

Games and physical drill are an essential part of our training. In the Marathon Race over the same course as last year, which covers more than 8 miles, 102 out of 103 who started actually finished. Eleven were unable to compete owing to illness. This is a tribute to the value of physical training and, although I shall not announce the time taken by the last man, the first (Cariapa) established a record for the course of 49 minutes 1 second. The games were only moderately well attended by some of the Rangers, and due notice has been taken of this in awarding marks for diligence and discipline.

The health of the students was not very satisfactory. We had one case of enteric, and there were during the rains and early cold weather an unusual number of malaria cases. Some accidents to limbs have also made the attendance rolls less satisfactory than is usual, but thanks to the interest taken by the Civil Surgeon in our students absence has rarely been of long duration.

The Inspector-General's Cup for the best all-round athlete has been awarded to Edgerley, with Taylor in very close attendance.

The monitor system has continued in operation, and is a proved success provided that students of the required stamp and personality are selected for these responsible offices. I must thank those students who have continued to help in the running of our educational work.

We are unfortunately losing one of our most efficient and popular instructors in Mr. Mason, who is proceeding on leave and takes with him the best wishes and regrets at parting of all with whom he has come into contact. Mr. Mirchandani is also returning to his province after a year's work at the College. We shall also feel his loss. Messrs. Trigg and Joshi have joined during the year. To Research Officers and Instructors I must express my thanks for the interest taken in our educational work. All forest officers in whose charges we have carried out our practical training have, as usual, rendered the most unselfish assistance and I must mention the names of Messrs. Bhola, Makins, Marriott and Herbert of the U. P. and Messrs. Shebbeare, Hom-

fray and Glasson of Bengal. The Principal of Roorkee College again most graciously spared Mr. Cumming to conduct the examinations in Surveying.

Some important changes in the rules of admission have been proposed during the year, and these proposals have now been referred to Local Governments for opinion. It is intended to widen the basis of examination for entrance to the Provincial Forest Service Class so as to include Physics and Chemistry as compulsory subjects, thereby obviating the necessity of teaching these subjects, in an elementary form, during our course at the Research Institute. The entrance test for the College, which was abolished in 1907, will probably also be re-introduced so as to attain greater uniformity in our students. The present system of adopting University and other standards results in great difficulty in valuation of attainments on a common basis, and it is felt that we are justified in reverting to the entrance examination, which has the added advantage of testing the candidates in the different provinces on a competitive basis.

The Bombay ranger students who returned to Dehra last after a short severance of their long connection with us will in future be trained at the Madras Forest College. The Burma Government has initiated a course of training for its provincial staff in connection with the Rangoon University, and the probationers now joining will probably be the last batch to be trained here for Burma. In spite of these secessions I do not fear for our future work. There will be a temporary lull in recruitment during the next two or three years owing to financial stress, but as soon as more normal conditions are restored the classes at Dehra will in my opinion again be filled to the full limit of our capacity. The Department must progress, stagnation means retrogression, and forestry must continue to expand with the general forward movement in this, as in every country.

We had hoped to have the Hon'ble Mr. Sarma with us to-day, but at the last moment he has been unable to come owing to other and more pressing work. It is fortunate, therefore, that the Hon'ble Mr. Mehta, Minister for Forests and Excise in Bombay, has been able to attend this function. He did not know when he arranged to visit Dehra, that he would be just in time for our annual convo-

cation, or he might have altered his dates. I hope, therefore, that he will favour us with a few of his impressions of Dehra and of our work and also with some words of encouragement and advice.

I shall now ask Mr. Clutterbuck kindly to present the certificates to the outgoing students.

Certificates were then presented by the Inspectar-General to the following successful stutents:—

PROVINCIAL FOREST SERVICE CLASS OF 1921—23.

HONOURS.

1. Sher Singh Sahni ... ... Kashmir State.

PASS CERTIFICATE.

2. F. A. B. Caelho ... ... Bombay.
3. B. A. Cariapa ... ... Madras.
4. W. N. Sharma ... ... Central Provinces.
5. L. O'D Nester ... ... Burma.
6. M. S. Rangaswami ... ... Madras.
7. F. M. Kewalramani ... ... Bombay.
8. Louis Felix Melizan ... ... Trinidad, B. W. I.
9. F. V. Webster ... ... Burma.
10. Leo Frank Edgerley ... ... Burma.
11. Naranjan Singh Jaspal ... Punjab.
12. Vasudev Rao Nakhare ... Hyderabad.
13. Satya Pal ... ... Central Provinces.
14. Narendra Nath Som ... ... Bihar and Orissa.
15. M. E. R. Taylor ... ... Burma.
16. V. A. N. Sausman ... ... Bombay.
17. Kahlon Dalip Singh ... ... Central Provinces.
18. Jitendra Nath Sen Gupta ... Bengal
19. Shugan Chand Kothari ... Jodhpur.
20. Sant Ram Modi ... ... Kashmir.

RANGERS CLASS OF 1921-23.

HONOURS.

1.	Shiv Das Mengi	Kashmir.
2.	Mahi Mohan Sirkar	Bengal.
3.	Makhan Singh	Punjab.
4.	Mulkh Raj Bali	Punjab.
5.	Shambu Nath Koul	Kashmir
6.	Jang Bahadur Lal	U. P.

HIGHER STANDARD.

7.	Nazar Mahomed	Punjab.
8.	Sukh Deo Prasad	Rewa.
9.	Priyanath Ker	Assam.
10.	Jog Dhian Sharma	Punjab.
11.	Samson Sitling	Bengal.
12.	Raghubar Datt Nauriyal	U. P.
13.	Achyntananda Baruah	Assam.
14.	Gurdit Singh	Patiala.
15.	Muni Lal	Punjab.
16.	Tejendra Mohan Ghosh	Bengal.
17.	Bharat Chandra Datta	Assam.
18.	Sant Ram Chaula	Punjab.
19.	Hira Singh Bist	U. P.
20.	Babu Ram	U. P.
21.	Narpat Ram	Mandi.
22.	Laiq Ram	Jubbal.
23.	Birindra Nath Roy	Bengal.
24.	Hakim Rai	Punjab.
25.	Chandra Singh Chand	U. P.
26.	Azizullah Shah	Punjab.
27.	Asghar Hussain	U. P.
28.	Harnam Singh	U. P.
29.	Hans Raj	Kashmir.

LOWER STANDARD.

30.	Sashi Bhusan Das Gupta	Assam.
31.	Paripurnanand Sakhlani	Tehri.
32.	Karam Singh Katuch	Punjab.

The Hon'ble Mr. Chunilal Mehta then presented the following medals and prizes to the successful students.

PROVINCIAL SERVICE CLASS, 1921—23.

MEDALS AND PRIZES.

Gold medal for highest marks *with honours*... ...	Sher Singh Sahni, Kashmir State.
Silver medal for Forestry ...	Sher Singh Sahni, Kashmir State.
„ „ „ Botany ...	L. O'D Nester, Burma.
„ „ „ Engineering,	F.M. Kewalramani, Bombay.
„ „ „ Surveying ...	Louis Felix Melizan, Trinidad, B.W.I.
Hon'ble Member's Prize for general proficiency in all branches of Forestry ...	F. A. B. Cælho, Bombay.
Hill Memorial Prize for Silviculture	Sher Singh Sahni, Kashmir State.
McCrie Memorial Prize for the best student in Working Plans	W. N. Sharma, C. P.
Indian Forester Prize for general proficiency (Best student who has not received any other prize) ...	B. A. Cariapa, Madras.
Inspector-General's Cup for the best all-round athlete,	Leo Frank Edgerley, Burma.
Prox. acc.	M. E. R. Taylor, Burma.

RANGER'S CLASS, 1921—23.

MEDALS AND PRIZES.

Gold medal for highest marks *with honours* ...	Shiv Das Mengi, Kashmir.
Fernandez Gold Medal for Utilisation	Mulkh Raj Bali, Punjab.
Silver medal for Forestry ...	Mahi Mohan Sirkar, Bengal.
„ „ „ Botany ...	Makhan Singh, Punjab.
„ „ „ Engineering	Mulkh Raj Bali, Punjab.

McDonnell silver medal (Best Punjab or Kashmir student)	Shiv Das Mengi, Kashmir.
'William Prothero Thomas' Prize for the best practical Forester ...	Samson Sitling, Bengal.
Indian Forester Prize for the best student who has not received any other prize	Shambu Nath Koul, Kashmir.

The Inspector-General of Forests then gave the following address:—

MR. PERRÉE, LADIES AND GENTLEMEN,—

It is with great pleasure that we welcome here to-day the Hon'ble Mr. Mehta, Minister for Forests and Excise in the Bombay Presidency. His presence indicates the great interest he takes in the subject of forestry. We are not only greatly honoured by his having consented to give away the prizes instead of Mr. Sarma, the Hon'ble Member who unfortunately was unable to come, but also by his kindly consenting to address us with regard to his impressions of Dehra Dun.

Mr. Perrée, the President of the Forest Research Institute and College, has given us a detailed description of the year's results, so there is no need for me to say much on this subject. The junior students will, I trust, benefit by his remarks and endeavour not only to do better in their second year but will strive to set up a good example for the new students to follow. On the junior students, now about to become seniors, devolves the whole duty of carrying on the continuity of the high tradition of which Dehra Dun has always been so proud, and we rely on them to do this.

Last year we congratulated ourselves on the return of the Bombay students to Dehra Dun. This year we are sorry to know that we are to lose them again, but fortunately our loss will be Coimbatore's gain. The reason for this unexpected change is due to the necessity for giving the Coimbatore Forest College an equal share of students.

As Mr. Perrée has told you Mr. Mason is now leaving us and going on a well-earned holiday. His departure will be a great loss both to the staff and to the students, for by throwing his whole heart into both work and games he has earned the esteem and affection of all. We heartily wish him Godspeed and a very pleasant time at home. We are also sorry to lose Mr. Mirchandani, Assistant Instructor from Bombay. He is leaving Dehra on account of the change in the place of training of the Bombay students which I have already referred to but we wish he could have stayed here a few years longer.

One of the greatest difficulties in forest education here is due to the lack of continuity in instructors. The number of changes in the teaching staff in recent years has been owing to a great extent to the shortage of officers after the War and to so many officers requiring leave. Now that the cadre of the service are gradually getting fuller, there is every likelihood of our being able in future to obviate such changes. In addition, however, to endeavours in this direction we hope to gradually build up a permanent nucleus of instructors who will not be liable to transfer.

Now, to you outgoing students of both classes I must say a few words.

I congratulate you all upon having finished your course of training and especially those of you who have won honours or prizes. I also congratulate you heartily on your choice of a career. If you will only keep up your energy and zeal, you will find that the forester's life is one of the happiest imaginable. In it you are always close to nature and to a great extent free from troubles and worries which are so often the lot of those who reside in towns. And at the same time what a wonderful scope you have for serving your country! Your great aim has to be to produce the best forest crops and returns from non-agricultural land. Just think of it. From time immemorial every endeavour has been made to get the utmost out of agricultural land and up to about 50 years ago no one in this country thought of doing the same from non-agricultural land. This line of thought will show you at once what infinite scope there is for you to help to

build up your nation. Nearly all the important countries of the world are important in direct proportion to their forest resources. Great Britain is the only exception due to her special climate and large resources of coal, which latter enable her to purchase all her timber requirements. If India is going to become a big nation, she cannot afford to neglect the development of her non-agricultural land. Under the management of the Forest Department there are 160 million acres equivalent to approximately one quarter of British India. Thus it is clear that if one anna profit is made from each acre each year, the total profit amounts to one crore of rupees. Actually the annual profits in all provinces aggregate to about two crores of rupees, that is an average of about two annas per acre. What a totally inadequate result you will say. We quite agree, especially since some of our best forests are already yielding 15 to 20 rupees per acre per annum.

I have mentioned these figures just to bring home to you the wonderful scope you have waiting for you in your careers. I need not emphasise the fact that revenue returns are not the whole goal to be aimed at. They are only an indication of the real value which properly managed forests are to the nation, from the agricultural, industrial, economic and climatic point of view.

Then, again, what a sphere you have for influencing good work in the waste lands not managed by Government. What can be done in this way, you have some of you seen in Etawah. There is much misunderstanding as to the objects and aims of the forest development, but you are all now aware that our sole aim is to advance India in every way, and I want you here and now to make up your minds that you will do forest propaganda work for the department throughout your service. You can do immense good in this way. You will of course have an uphill fight as there are always existing conditions which are considered by those interested to be more important to themselves than the building up of the resources of the nation. But if you will steadily preach the gospel of forestry you will not have lived in vain, and you will be, I feel sure, rewarded in time by seeing your country advancing steadily to a great nationhood. Just a few words more

to impress upon you the special importance of exercising your imagination. Don't go about the forests observing only what the state of the tree-crop now is, but all the time, and every time think of what the crop could be a rotation hence, if you do your job properly now. To the forester who so seldom sees the final results of his work, a vivid imagination is the most important asset.

Then I wish to warn you against thinking only of work. This I am afraid is a fault of which most of us, foresters, must plead guilty and is due to spending so much of our lives more or less alone in the forests. The great corrective is a hobby, and I strongly advise all of you to definitely take up some hobby which will be a relaxation from your work, especially when you are away in the jungles by yourselves. Finally I wish you all very successful, useful and happy careers.

And now with a hearty endorsement of the President's thanks to all members of the educational staff, to the research officers who have lectured to and instructed the students, and to all the territorial officers who have so ungrudgingly given their assistance, I conclude my remarks.

The Hon'ble Mr. Chunilal Mehta then gave the following address: —

MR. CLUTTERBUCK, MR. PERRÉE, LADIES AND GENTLEMEN,—

Had I known, when I informed Mr. Perrée I wanted to come and see Dehra Dun, that this function was to be held I might have changed my dates, but I am very pleased at having the privilege of meeting you here all in a body and at a time which, I am sure, the students of any College consider is the most important in their yearly work. Your President has asked me to give you some impressions of Dehra Dun. Well, I will not venture to copy the proverbial globe-trotter who does not hesitate to give to the world his impression of a two or three days' or two or three months' visit to India, but I will tell him that in Bombay we have got a College, not unfortunately a Forest College indeed, but an Agricultural College of which we are very proud. It draws students from all over India, from far Burma, from outside India, from Ceylon and I believe also from the Federated Malay States, but when I see students here from

all over India and from so far as Trinidad, and when I know also that this place is going to develop into a much bigger College, according to the decisions of the Legislature, and that in addition it has got a magnificent Research Institute, which creates the true atmosphere of a Forest University, I begin to feel that it is time that Bombay should look to its laurels, and that Bombay will have to recognise that, after all, a place in charge of the Government of India is a bigger place than any to which a mere Province can hope to attain.

Well, this atmosphere of a Forest University is one of the most valuable assets of forest education and I congratulate the Bombay students, particularly the Ranger students, who will be the last batch, unfortunately, who will have the good fortune of imbibing this excellent atmosphere, and I will now ask not only the Bombay students of the Ranger and the Provincial Classes but all the students who have had the good fortune of passing through this place, to carry out their impressions of great tradition in the work which lies before them, and which has been so vividly pictured to you by the Inspector-General of Forests. You are in a somewhat happy position when compared with other students who pass from other colleges. After passing their real difficulty commences. It is not really a passing of the examination, but it is really afterwards that the real difficulty of their work in after-life commences. We have found that in the Agricultural College. But you pass out, after an excellent training, straight into your profession, and there is no time for damping the ardour of many an enthusiastic young man who goes out of College with brave ideas, but who unfortunately may not have the means or the opportunity of carrying them out in his profession, so that with this advantage before you, the Inspector-General was perfectly correct in insisting upon the high standard that must be expected from all Dehra men. Both Provincial and Ranger students, and perhaps in a more strict sense, the Ranger students, really form the backbone of the Forest Service in India, and it has been our endeavour, and I am sure it is the endeavour of every Province in India, to see that the Ranger gets an opportunity later on in life, of rising

to a higher position, and that he has a right to feel, like every soldier, that he has got a marshal's bâton in his knapsack.

Now, gentlemen, I mention this to you with two objects, not only because I wish to hearten you with the prospects of a better career in the future, but also because I wish to impress upon you that there are disappointments in forest careers just as in any other career, and that it is the forest man's job not to be disheartened by those disappointments, but to look at them in the same way as he looks at the little teak tree that he may have planted, the results of which neither he nor perhaps his son may see. Now, that to my mind is a very characteristic feature of all forest officers. They have magnificent traditions, I know. I am only speaking from a couple of years' experience, but I say, that it is impressed upon my mind very thoroughly that the forest officers in India, both Europeans and Indians, particularly Europeans, who hold the major portion of the higher offices now —that they look to their work without being sure that they will ever be able to see the results of it, and they are so keen on their profession that they have often, I believe always, been accused of thinking and of talking of nothing else but forests.

There are two matters to which I should like you to devote your particular attention. In the present economical state of the country, and, I am afraid, in the greater materialistic wave that is also sweeping across the country, you will be asked to devote your special attention to the production of revenue. That, without doubt, is an important part of the forest officer's work. But there is another, and perhaps a greater work. The forests, as the Inspector-General has explained to you, are a national asset, and the work of the forest officer, particularly the Ranger—who daily comes into contact with the people of the country, the poor raiyat and the cultivators all round—his work is to conserve the resources of the forests of this country for future generations —an idea which is a problem to the great majority of the people, both uneducated and educated, in this country from whom it is perhaps unnatural to expect an outlook much beyond their personal interests, and the needs of their own generation. It is the ranger's job, the provincial and the higher officers' job, to see that interests of future generations are not sacrificed to the

present necessity of providing revenue, and also it should be their particular work to see that in the carrying out of their duties which, I know, bring them into a good deal of conflict with the short-sighted poor cultivators, it is for them to make allowances for the other men's ignorance and for his every-day necessities and to deal with him as gently as the forest interests will permit. I know from personal experience the antagonism that exists, and I believe it is not confined either to my little Presidency or even to this country, but in all countries there is that conflict between the long-view that the Forest Department must take and the short-view which unfortunately through ignorance or through necessity are forced upon the vast majority of the cultivators.

Now, I do not wish to preach to you any more, indeed I am hardly qualified to preach, but I would like to refer to one little item of the programme of to-day which I think is of very great importance in a forester's life. It is not only the attention to study, but the great interest that the students have taken in sports and in outdoor life which is one of the most heartening things that I have seen this afternoon. Prizes have been given and have been won for tests of physical endurance and for out door sports, and I have heard that in the noble game of cricket, too, this College is able to hold its own against the whole of Dehra Dun and probably the whole of the U. P. We attach a certain amount of importance to this game, not because it forms any test of physical endurance but because proficiency in this game necessarily means the development of those qualities which all forest officers will be called upon to display in their work in the future. There is no time to wait when a fast ball is getting at your wicket ; you have to make your decision quickly and you have not anybody to ask you must take your own initiative, you must make your decision rapidly, and you must make it with courage. That is what the rangers will be asked to do. That is what they will be expected to do, even though the very strictest discipline and obedience to orders of their superiors will be expected of them in the furture ; and I am perfectly certain that, with the excellent material which, I take it, is only a sample of what is yearly turned out from this

6

Institution, these expectations will be fully realised, and that we can rely upon it that forest interests will be safe in the hands of such fine material as we see this afternoon.

One word of thanks and I feel I may say that, because I fully appreciate the kindness of the officers here who have put me into the chair, and I am sure they have done it more out of a spirit of hospitality and kindness than because they have any respect for the knowledge of a layman who has only began to take an interest in forest matters a couple of years ago but who is still learning and will continue to learn, and whose interest in forestry will continue to increase, as time goes on.

At the conclusion of the proceedings, a garden-party was given, in the College grounds, by the Imperial Forest Service Officers and Imperical Research Officers, to the other members of the staff, past students, present students, together with the ladies and other guests present. After which, the visitors inspected specimens of the students' work during the past year, such as drawings and utilisation collections which were displayed in the College building. Some recent additions to the collection of models in the College gallery were also seen.

EDITORIAL NOTES.

We were pleased to note that the degree of Doctor of Science has been conferred on Professor R. S. Troup, by the Board of the Faculty of Natural Science of Oxford University, for his researches in Silvicultural Science, and we beg to offer him our hearty congratulations.

OBITUARY.

PANDIT DAYA RAM.

We much regret to announce the death of Pandit Daya Ram, Extra-Assistant Conservator of Forests, attached to the Dehra Dun Division, U. P., which occurred suddenly from heart failure on the 5th April, 1923, when he was with the Conservator and Divisional Forest Officer on forest-inspection duty near Lachman Jhula, Dehra Dun Division.

Daya Ram belonged to that old school of foresters, who, by their hard and conscientious work, had played an important part in the development of the various activities of the Forest Department.

He was descended from a Gurkha Brahmin family which lived in a village in Nepal. He was born on 21st July, 1869. He received his early education in the Mission High School, Dehra Dun, but circumstances prevented him from bestowing much time on it. In 1890 he got an appointment as a Naik in the 6th Company, Bengal Sappers and Miners, Rawalpindi. In that capacity he did very good work in the Isazai Expedition. He was not only awarded a certificate for good work, but was also recommended by the Officer Commanding, for the Forest Service; so prior to joining the Imperial Forest School, Dehra Dun, as a stipendiary student in 1893, he was appointed a forester and posted to the Chakrata Division. In 1895 he finished the two years' course in Dehra Dun, and obtained a Forester's certificate.

He was deputed to the Tehri State in 1897, where he served till 1901. The State was eminently satisfied with

his hard and honest work there, and wanted to acknowledge it by paying him a substantial present which, however, he had to decline owing to Government orders. After his return from Tehri he served in the Chakrata, Dehra Dun, and Naini Tal Divisions as a Range Officer. During the famine of 1907-08 he did very good work for which he was given a certificate by the Lieutenant-Governor.

In 1913 he was promoted to the Provincial Service, a promotion which was richly deserved and which was really overdue, considering his very meritorious work. Most of his time, before and after that, was spent in the Chakrata Division, where he has left his mark as a most practical forester and forest engineer. The many successful plantations and various works of exploitation in those alpine forests bear testimony to Daya Ram's industry and interest in forest work. In October, 1922, he was attached to the Dehra Dun Division, and here he worked with his usual conscientiousness, loyalty, and faithfulness and died in harness—a high tribute to his character ; he was made by work and died in work.

Daya Ram could not be said to possess the higher gifts of genius, but in points of industry and perseverance few could equal him. In his official life he was admired and respected by his superiors and subordinates alike, and in society his habitual cheerfulness and good humour, amiable manners, and benevolent disposition rendered him a delightful companion and a universal favourite.

Few forest officers or forest students who have visited the Chakrata forests in past years will fail to remember Pandit Daya Ram for his universal courtesy and readiness to help in any and every way. The ease and comfort with which the tours were performed were almost always trace-

able to our late friend's influence and tact in dealing with the local people. The Research Institute and College unite with the officers of the United Provinces in mourning the loss of a valued friend and colleague.

PROVINCIAL STUDENT B. B. SIRCAR.

On the evening of April 25th, when the Senior Provincial Class were at Thadiar, a request was made by a timber contractor for help for three of his sawyers, who were stranded on a log in the Tons River.

These men had gone out on the end of a rope to release the log, but had let go of the rope and were unable to return on account of the raging current, due to snow-water.

The whole class went down with the Instructor, and it was decided to attempt to take out the rope to the men, as they had been there for some hours, were cold and wet and it looked as if they would be washed off if the attempt were delayed until morning. Although it was about 7 o-clock in the evening there was the moon, and the prospect of effecting a rescue was fair.

The first attempt was made by Students Tun Ngwe, Grange, Ferdinands, Ferozuddin, Dutta, and Mr. Simmons, who swam out with the rope.

Owing to the current and the size of the rope (3' 4") it was necessary to start well up stream. The attempt failed as the rope was too short, and the party were unable to get within a distance of more than 3—4 yards of the log. In this attempt Mr. Simmons damaged his feet and could not take part in any further attempts.

The second attempt was made by a Forest Guard from Thadiar, who swam out with a light line and reached the log. The intention was to tie the big rope to the line and

pull it out. The light line however broke, and there were now four men stranded

The next thing was to unravel the large rope and, when this was done, Students Tun Ngwe, Ferozuddin, and Dutta again went out with two more students, Das and Sircar.

This party reached the log, but Das was in difficulty as he never actually got there. The whole party then jumped in the river and were dragged and drifted ashore. Das was unconscious, and Dutta fainted on reaching the bank. Unfortunately Sircar never reached the bank. What happened to him exactly is not certain, as owing to the shadows it was difficult to make out details. He was, apparently, washed off the rope when about half-way back. Whether the accident was due to an attack of cramp will never be known. It may be remarked that the water was intensely cold, the current very swift, and the river-bed is a mass of rocks. Search parties were sent down both banks at once, but no trace of Sircar could be found, though search was kept up till after mid-night. While offering the sympathy of all who knew Student B. B. Sircar, both his fellow students and those of the staff at the Research Institute, who came into contact with him, there is only one consolation which we can tender—Student Sircar gave his life to help others, and by his courage has set an example which will not be forgotten.

Before he went out attempts were made to dissuade him, as he was not as strong as the others ; but he refused saying that his fellow-mess mates, Das and Dutta, were going, and he must go, too. The sympathy of all will go out to his father, Babu Satish Chandra Sircar, a pleader of Burdwan, who is an invalid, in losing his eldest son. He can rest assured that the manner in which his son met his end is one of which the whole Forest Service is proud.

REVIEWS AND EXTRACTS.

REVIEW OF THE FOREST ADMINISTRATION REPORT OF MADRAS FOR THE YEAR 1921-22.

In this volume are contained the reports of the Conservators of six Circles and the Principal of the Madras Forest College, to which is appended a short review by the Chief Conservator.

The report covers a period of twelve months, and a comparison of the figures with those in the report for 1920-21, which covered a period of nine months only, would therefore be of little value.

The work of the Forest Department was greatly handicapped during the year under review by the lawlessness prevalent throughout large areas of the Presidency. Organised defiance of the Forest Law, promoted by members of the non-co-operation movement, rendered forest protection impossible in several districts. Frequent cases of assault on forest officials occurred, and three Forest Guards were murdered. The Moplah rebellion, although not directly connected with the Forest Department, caused great loss, as all the principal forest buildings in the important Nilambur Division were looted and burnt, records were destroyed, and work was dislocated for six months, rendering it impossible to float any timber down to the coast or to carry out the annual fellings. Lawlessness and rebellion were responsible for an increase of forest offences, a loss of revenue, and considerable disorganisation of the working of the Department.

During the Moplah rebellion the forest staff behaved exceedingly well, with very few exceptions, and through their exertions all the elephants belonging to the department were recovered, except one.

The impossibility of protecting certain areas of forest from fire year after year has been recognized in some Divisions, and the system of early burning under departmental supervision has been

introduced. These early fires do very little damage to the growing stock, being much less intense than fires in the hot weather ; and it is likely that this system of early burning will be extended in the more open types of forest. A word of warning should, however, be given regarding its employment in valuable sandal wood areas, as this species is peculiarly susceptible to damage from fire.

Little progress was made in the preparation of Working plans, and it is stated that the preparation of regular working plans for the large timber forests must await the formation of an engineering branch of the department, which will organize schemes for concentrated working on a large scale with the help of mechanical appliances. The formation of this branch is now being undertaken and Government have sanctioned the appointment of a Chief Forest Engineer. A large sawmill has been erected at Russelkonda in the Ganjam Division, and started working just before the close of the year.

A scheme has been drawn up for the working of the Chenat Nair forest on the Western Ghâts. Roads, drag-paths, slides, and buildings have been constructed, and two Holt five-ton caterpillar tractors were purchased towards the end of the year, as well as a large quantity of logging tools and gear. The Madras Government seems willing to sanction expenditure on the development of schemes which give promise of good financial return and it is to be congratulated on its enterprise. It is to be hoped that the Forest Department will be able to overcome the many difficulties inseparable from the working of intricate machinery in remote jungle places, and that the Government will not be disappointed if the working of the first few years does not yield them, the large return which they doubtless hope for. The inauguration of these new methods of working takes a long time to accomplish and entails many difficulties and disappointments. It is hoped, too, that in their anxiety to explcit these hitherto unworked forests, the Government will not lose sight of the necessity for providing funds for plantations and other necessary cultural works. There is a strong tendency in some Provinces nowadays, when every rupee of revenue is welcomed

and every pie of expenditure criticised, unduly to subordinate the care for the needs of future generations to the easing of the burdens of the present.

The chief silvicultural problems with which the Department has to deal are those connected with the regeneration of the deciduous teak forests, the evergreen forests of the Western Ghats, and the sal forests of Ganjam. As regards teak, the system of clear-cutting followed by sowing or planting, which has been such a conspicuous success at Nilambur, is now being successfully adopted in other forest areas. In the evergreen areas the problem is not so simple, as, although there is usually a plentiful crop of young growth on the ground at the time of felling, the seedlings of most evergreen species require a certain amount of shade for a number of years, and die off if the overhead cover is removed too suddenly. Experiments in various methods of regeneration in evergreen forests are now in progress. To ensure economy in intensive methods of exploitation, it is essential that the standing crop be removed in as short a time as possible, due consideration being given to the problem of regeneration. In the Ganjam sal forests regeneration is a simple matter, as a prolific natural crop of young sal comes up as soon as the old crop has been clear-felled.

The financial results of the year's working were disappointing, showing a deficit of nearly half a lakh, as compared with a surplus of nearly twelve lakhs during the previous year. Heavy expenditure on sawmills and extraction plant, increased salaries and travelling allowances, and the loss of revenue owing to the cessation of working at Nilambur in consequence of the Moplah rebellion account in part for this state of affairs. Surely the time has come when Capital expenditure on permanent schemes of development should not be charged against revenue, but should be financed from a loan, interest and sinking fund being charged on this annually for a fixed term of years.

Some years ago a system of forest panchayats was introduced for the management of forests which are worked mainly for the supply of fuel, leaf manure, and grazing to the resident local population. The system has not proved satisfactory up to

now, and an attempt is now being made to improve matters by putting the management of the panchayats under the direct control of the Chief Conservator.

With a view to keeping the Government in touch with non-official opinion in regard to forest policy, a Forest Advisory Committee was formed consisting of non-official members of the Legislative Council presided over by the Honourable Member in charge of the Forest portfolio.

A welcome rise of pay was sanctioned to the members of the Provincial Forest Service; the revised scale is Rs. 250-25-900, with an efficiency bar at Rs. 600.

The Government Order passed on the report pays a high tribute to the Chief Conservator and the staff serving under him for their loyal and valuable services, in circumstances of exceptional difficulty.

AMERICAN FOREST REGULATION

BY THEODORE SALISBURY WOOLSEY, JR. M.F.

Published by Messrs. Chapman and Hall Ltd., London.

Price 18 *shillings.*

Mr. Woolsey defines Forest Regulation as that branch of forestry which concerns itself with the organisation of a forest property for management and maintenance, ordering in time and place the most advantageous use of the property, with the aim of securing a sustained yield. It is, therefore, practically what we mean by "regulation of the yield."

The book is divided into two parts and has serial appendices but as Part I is by Mr. Woolsey, Part II by Mr. H. H. Chapman and the Appendices are translations from the German or separate notes in themselves, it really consists of two separate though connected books and a series of translations and articles all bound together. Owing to this arrangement it is necessary to review the book in parts.

Part I which is entitled Policy and Theory of Regulation contains 9 chapters with the following headings: Chapter I,

Introduction to Forest Regulation; Chapter II, Background of a Regulation Policy and a Sustained Yield ; Chapter III, Management and Administration sub-divisions ; Chapter IV, Rotations—Technical, Silvicultural and Economic ; Chapter V, Financial Rotations ; Chapter VI, The Normal Forest ; Chapter VII, Regulating the Cut ; Chapter VIII, (A) Volume Methods of Regulation ; Chapter IX, (B) Area and (C) Area—Volume Methods of Regulation.

After a preliminary account of what Forest Regulation really is, Mr. Woolsey goes on to point out the necessity of a definite regulation policy and adduces many trite arguments in favour of a sustained yield.

He states that America after cutting or burning half her forest resources is still felling what is left, more than four times as fast as it is growing. The result of this is self-evident and from it he deduces the importance of research work regarding increment and rates of growth, and though he admits that there must be a balance between policy, economic conditions and research he adds that research is often so all important that it may come first, and he regrets the present tendency to put too much stress on economics—an opinion which has been so often expressed all over the forest world in recent years. We all realise the vast importance of the economic side of forestry, but it is ultimately dependent on the regeneration and rate of growth.

The arguments in favour of a sustained yield are excellent but Mr. Woolsey is no blind upholder of the policy, and he gives perfectly good examples of cases where the sustained yield principle would not be good policy. One sentence we must quote to our shame, " Some administrators (British India is an example)" he says " desire to make a good financial showing ; consequently they may be led to cut more than the forest produces " It is beneficial sometimes to see ourselves as others see us. He adds," The working-plan officer must be enough of an idealist to combat the every day arguments of the opportunist administrator."

The whole of Chapters IV to IX are very detailed and technical. All the best known formulæ for yield calculation are analysed and compared. While we agree in the main with wha

is written, these are points where many will join issue. There are, by the way, some misprints in the formulæ on page 61. Towards the end of these Chapters, Mr. Woolsey brings out some important points, "There is another important point in policy to be considered, in weighing a method. How much accuracy is justified in extensive conditions? To my mind a crude method that will give rule of thumb results is sufficiently accurate . . ." He then goes on to point out that a rough regulation of the yield and sound silviculture is probably the soundest policy over large areas where the forests are often abnormal and where the yield calculation can at best only be a guide.

Part II, entitled Correlation of Regulation and Growth in Extensive American Forests, contains four chapters. The cutting Cycle as a Determining Influence in American Forest Regulation; The Application of Regulation to American Forests; The Problem of Sustained Yield; Regulation of Forests Composed of Even Aged Stands. Although it contains a good deal of theoretical matter, it is largely the practical application of the theories in Part I, to the existing irregular crops of America, often composed largely of overmature trees.

Mr. Chapman looks at the whole problem from a new point of view, and though some of his theories are unconventional, they certainly offer ideas to those who have to deal with large areas of virgin or more or less virgin forest. Apparently in America they have also found that plans, based on the fact that one valuable species occurred among a lot of inferior species, were liable to be much upset by the increasing value of the former inferior species for he lays down that "in cases where originally a single species is merchantable in a mixed stand, it is almost inevitable that later on, the remaining species will become merchantable. In this case, the *growth* required will be the economic growth of markets and stumpage values. The first cutting cycle cannot be based solely on the period required to produce an equal yield of the given species, for the chances are that this single species, as a result of cutting in a mixed stand, *will decrease in numbers and growth by suppression.* The cutting cycle may be based on the combined factors of growth of the species in question and future merchant-

ability of the remaining species. The total growth of the stand not that of a fraction of it, is the only safe basis of regulation." While in India we wish to take special steps to prevent our valuable species decreasing in numbers, there are few who will not admit the truth of the last sentence quoted.

The Appendices give a useful account of the Forest Management in nine European States, and a discussion on financial rotation besides other matter of minor importance.

The book contains a tremendous amount of useful matter. Our criticism of it is however that it is not always expressed very clearly and the whole book seems rather disjointed.

So technical are many of the discussions, that it necessitates careful and repeated reading to realise exactly what it is all about. We consider this detracts from the merit of the work, in that it will not appeal to the ordinary forester.

S. H. H.

THE BURMA FOREST MAGAZINE.

The first number of this new Magazine has been received and read with considerable interest. The editorial explains in a few words the origin and objects of the Magazine which is the outcome of the formation of the original Burma Forest Club. This club has been reorganised and is now known as "the Burma Forest School (old students) Club" and this Magazine is to be its mouthpiece. Its chief object is to act as a means of intercommunication between the members of the club and between the branches of the club which are distributed throughout the various Forest Divisions of Burma. With this end in view, the Magazine will contain many items of interest under the heading of club notes, school notes, domestic occurrences, notifications and office orders, correspondence, etc., and in addition to these there will be articles by members of the club and others, extracts, reviews, etc. The number under review is excellent reading, and the apologies of the editor in his explanatory note for its deficiencies are hardly called for. The articles are in the main written by Range officers and others of the Subordinate Service, and this fact in itself is sufficient to make this Magazine, a publication of

special interest not only to Club members, but to all Forest officers, throughout India and Burma, and if Burma's budding authors come forward in future with contributions of the same standard as appear in this issue, the Magazine should have no difficulty in maintaining the position to which it aspires. When reading these articles it occurs to one to wonder how it is that so many new contributors have suddenly sprung to light, when it is well known that the *Indian Forester* for many years past, has been calling loudly for original articles with very little response from Subordinate Forest Officers. Is it that these many authors have been hiding their light under a bushel all this time and were alarmed at the prospect of seeing their literary efforts in print n the major periodical? If so, it is time the *Indian Forester* looked to its laurels and it should take this opportunity of inviting contributions from these shy members of the Burma Forest Service. Otherwise Provincial offsprings such as this Magazine and the Madras Forest Magazine will be getting all the cream, and then, "what about poor old Father"?

In the meantime we wish the Burma Forest Magazine all good luck in its career so well started.

H. T.

VOLUME XLIX NUMBER 8

INDIAN FORESTER

AUGUST, 1923.

THE FOREST DEPARTMENT AND THE 'AXE.'

Owing to the simple fact that it takes a considerable time to grow trees to exploitable size, no country can afford to rely for her timber supply on chance improvisation in case of dire necessity. Any mistakes once committed in handling the problems of a country's forests will take a very long time, perhaps centuries, to rectify. Hence it is very necessary in the interests of the country to examine closely the attacks of the Retrenchment Committee on the Forest Department, especially as the national aspect of forestry is hardly, if at all, realised in India.

In their attacks upon the Forest Department the Inchcape Committee have simply tried to emulate the example set before them by their prototype the "Geddes Committee" in England. Forest Conservancy is a great national investment as well as national insurance with great remunerative prospects, and

bringing the axe to bear upon it is simply trying to kill the goose which lays the golden egg. The British nation has never displayed any keenness for the conservation of her forest wealth, and used to rely upon foreign imports for her timber supplies till the Great War demonstrated the folly of such a course. And so it is not surprising to find the jettisoning of the Forest Departments in India and England. India has, in face of these facts all the more reason to be grateful to Lord Dalhousie for laying down a definite Forest Policy as far back as 1855. But the adoption by an administration of any policy does not mean the realisation of the true import of that policy by the nation, and it certainly did not mean that in the case of the policy of Forest Conservancy in India. Though, as a result of the labours of the Forest Department for over three-quarters of a century, India to-day occupies the position of the pioneer of forestry in the British Empire, there is no doubt that the utility of the forests to the nation is hardly recognised by us. Forest politics in India are in a frightfully low stage of development compared with the European countries, where forest problems occupy a definite position in a political party's programme, and the party's attitude towards the national forests goes a long way towards influencing its fate at the polls. We are, in India, far behind that state; even in England things are in no way better, in spite of the experience gained during the late war. But England is fortunate in having some redoubtable advocates of forestry like Lord Lovat, but for whose unflagging zeal and untiring efforts in the cause of forestry, the British Forestry Commission would have not been able to survive the throes of birth. In India there is not a single public man taking any active interest in forestry, the electorate is too ignorant to realise the great potential value of forests, there is not a single society which has for its object the furtherance of the cause of forestry, no forestry journal except the *Indian Forester**, is published. In face of these unpleasant facts, which bode ill for India's forest wealth, it is not surprising to find the

* There are, as far as we know, besides, three other forestry journals in India, at present, namely, "*The Madras Forest College Magazine*," "*The Burma Forest Magazine*," edited respectively at Coimbatore and Pyinmana, and a weekly forest paper, recently started at Madras, called "*The Junglewallah*."—[Hon. Ed.]

work of the Forest Department, subjected to unwarranted hostile *criticism.*

It is not intended to rhapsodise here on the various advantages of forests, physical, social, economic, and political, but it may be mentioned that no country can afford to neglect her timber resources in modern times, where timber experts are predicting a famine in the near future. England is the only great nation to-day without adequate forests, but what she lacks at home, she has in her possessions abroad. The part played by the French forests during the Great War is little known outside France, and the position which the forests occupy in the French eyes can be judged from the fact that an individualistic nation like the French, has consented to an encroachment upon the individual's liberty in her Forest Code. The members of the French Academy write non-technical books upon the national utility of the forests, and deputies and members of the Senate take active interest in forest questions.

For about three-quarters of a century the Forest Department in India has been working under the most discouraging circumstances—the masses look upon the forest officers, who have to perform the thankless task of protecting the interests of future generations from being subordinated to the expediency of satisfying immediate popular clamour, as oppressors, the intelligentsia of the country regard them as needless, their work is hardly recognised, and they have to be content with thinking in terms of centuries, leaving it to future generations to recognise their work. And yet the record of their achievements constitutes one of the most glowing chapters in the history of British administration in India. Under these circumstances it hardly serves to ameliorate the unenviable position of forest officers to subject their work to such criticism as was made by the Retrenchment Committee.

Let us then examine the charges levelled against the Forest Department by the Retrenchment Committee. The first charge is that the Forest Department is not run on business lines. Now the area under the management of the Forest Department is

classified by the Government of India under the following four heads :—

(*a*) Forests whose preservation is necessary on physical of climatic grounds, *e.g.*, forests on water catchment areas, forests for prevention of denudation along hillsides, etc.

(*b*) Forests which supply valuable timbers, and in whose administration, returns form the main consideration.

(*c*) Minor forests mainly containing inferior species whose main object is to meet the local demands for fuel, timber, fodder, etc., in agricultural districts.

(*d*) Pasture lands which are merely grazing grounds under the management of the Forest Department.

In the case of the first of the above classes the indirect benefits of the forests far outweigh the direct benefits, as estimated from a commercial standpoint, and so it is impossible to manage such forests on strictly business lines. The great importance of such forests can be realised from the following anecdote. Owing to the destruction of forests serious floods occurred in the valley of the Rhone which endangered the safety of the neighbouring villages. Napoleon called the best engineering talent of France to devise some solution of the problem. The engineers after a careful survey of the locality submitted that, if all the wealth of the world were available it would not be sufficient to defray the expenses of the engineering construction necessary to check the floods. But the Forest Department came forward with a scheme for afforestation of the bare hills occasioning little expense. How far the forests created as a result of this scheme have mitigated the evil is too well known to need any comment. But in spite of their great importance it is impossible to estimate the benefits of such forests—"protected forests" as they are technically known—in terms of rupees, annas and pies.

The great importance of the third and the fourth classes can be realised from the following figures which show the amounts

of forest produce removed by right holders and free grantees in the year 1918-19:—

Timber	... ...	5 million cubic feet.
Firewood	... ...	80 " " "
Bamboos	... ...	About Rs. 22,000 in value.

Grazing and fodder grass.—About Rs 38,000,000 in value. Most of the free grantees are poor people in villages not far from the forest, who depend for their very sustenance upon the products of the forest, and without which it would be impossible for them to eke out their miserable existence. In some cases small charges are made for the removal of forest produce, but they are only nominal. In times of famines these forests have to meet greater demands. Dr. Voelcker recognises the great importance of these forests in his recommendations for the improvement of agriculture in India. Thus the only forests whose management is on commercial lines are those belonging to the second class; even in their case the object of management is twofold—first conservation and improvement of forests and secondly the attainment of maximum net profits to the tax-payer, and one is as important as the other. In view of these facts it is absurd to assert that the Forest Department is not run as a commercial concern, it was never meant to be run like that and the utmost that it was to do, was to manage the forests under its charge in the most profitable way, as far as consistent with other demands; and it is not too much to say that in no country is so much stress laid on the profitability of afforestation schemes as in India—a fact clearly borne out by a comparative study of the proportions of expenditure to revenue in different countries. In Switzerland, for instance, the result is considered quite satisfactory if the forest administration can pay its way, whereas some of the forests are actually managed at a loss, and yet the Department is not "axed," simply because the indirect benefits accruing from forests, for example providing employment to so many people, insuring national safety in case of emergency like the late war, protection of land from denudation, etc., etc.,—are too well appreciated by the people as well as by the government. It must not be forgotten that according to the census of 1911, 1,585,464 people were

employed in India on forest work and industries depending on forest products, and if anything, the number must have increased considerably since then.

As all the above facts are of great importance in national economies, and yet cannot be ascribed any monetary value, financial results form a poor criterion with which to judge the work of the Forest Department. Still the financial results achieved constitute a harvest of no mean order as the following statement will show :—

Financial Results of Forest Administration in British India from 1864-65 to 1918-19 (in lakhs of rupees).

Quinquennial period.	Gross revenue average per annum.	Expenditure average per annum.	Surplus average per annum.	Percentage of surplus to gross.
	Lakhs.	Lakhs.	Lakhs.	Lakhs.
1864-65 to 1868-69	37·4	23·8	13·6	36·4
1869-70 to 1873-74	56·3	39·3	17·0	30·2
1874-75 to 1878-79	66·6	45·8	20·8	31·2
1879-80 to 1883-84	88·2	56·1	32·1	36·4
1884-85 to 1888-89	116·7	74·3	42·4	36·3
1889-90 to 1893-94	159·5	86·0	73·5	46·1
1894-95 to 1898-99	177·2	98·0	79·2	44·7
1899-00 to 1903-04	196·6	112·7	83·9	42·7
1904-05 to 1908-09	259·0	141·0	116·0	45·1
1909-10 to 1913-14	296·0	163·7	132·3	44·7
1914-15 to 1918-19	371·3	211·1	160·2	43·1

(Quinquennial Review of Forest Administration in British India for the period 1914-15 to 1918-19.)

The above figures need no comment, but it may be pointed out that all tending operations and other works of improvement,

which cannot be expected to give immediate returns, have been met out of revenue.

It is not intended to suggest that the Forest Management cannot be improved in many ways, but a wholesale condemnation of the Forest Department, as unbusinesslike is hardly justified by actual facts.

As regards the second proposal of the committee to place the Forest Department under timber trade expert, this step may ensure sound business, but it will at the same time gravely endanger the scientific management of forests. The risks of this proposal are well demonstrated by America, where during the early days of forest administration business considerations outweighed sound forest management with the inevitable result that America's forest resources are greatly deplected to-day. A business man can rarely rise above the petty consideration of profit, even when circumstances demand it. It is inconceivable that the afforestation of the denuded ravine lands of the United Provinces, or of the *chos* of Hoshiarpur could be entrusted to a timber trade expert, whose attitude towards forests, is bound to fluctuate with the vagaries of the timber market. It is interesting to note here that some eminent Frenchmen think that, even the minister in charge of the portfolio of forests must be a trained forester.

It is true that the business of marketing forest produce may be left to those who have a more intimate knowledge of the commercial world, and the inauguration of the utilisation branches in some provinces is a step in the direction of the division of functions indicated by such a principle. That such a division of functions has not yet been affected is due mainly to financial stringency, rather than to any reluctancy on the part of the Forest Department to accept the principle. But it is absurd to put a timber trade expert as the head of the Forest Department.

As regards the proposal to cut down the annual expenditure, which is mainly on the Forest Institute and certain minor administrations, it may be said that in the latter case, the expenditure is a mere business proposition, the initial outlay of which will be redeemed in due course, and every year's expenditure generally brings more than an equivalent amount of revenue,

besides leaving the forests in a highly improved condition, a word may be said as regards the former. The great importance of research in any science cannot be over emphasised, and that consideration applies to forestry in India with greater force, as in addition to assimilating the results of latest researches all over the world, there are certain problems peculiar to India which have to be solved here. In forestry nature has to be closely studied, followed, cajoled, and sometimes coerced. Now, that must necessarily be a tedious process, and it is the aim of research to devise short cuts to the ultimate goal. The gain in time and money which these short cuts ultimately yield cannot be over-estimated. It is hoped thata passion for pinchbeck economies will not be allowed to override the consideration that, expenditure on research is bound to prove, in the long run, the truest of economies. "The combination of research into problems of production and utilisation, if continued and encouraged, must result in a fuller realisation of our forest resources, which, after all, is the main object in view."*

Financial strigency, reflected in indequate staff and ill equipment, is already retarding research work in the various branches, and if the cuts proposed in the forest expenditure are adopted, much of the very useful work now being done at the Central Institute will have to be stopped.

The Forest Department in India suffers from a peculiar handicap owing to lack of any assistance from scientific societies and universities of the country in the investigation of the many problems, such as is available in European countries, and consequently the field of its activities is very wide, and urgently needs further expansion. In her forests India possesses a national asset of great potential value which if properly managed without being restricted by the recommendation of a committee, which impatient for economy, had little time to consider the forest problems in all their diversity, will play a great part in her economic rejuveration. Experts predict a timber famine in the near future, but India need not entertain any apprehensions if the Indian Forest Department can only be extended proportionately to the

---

* Forest Research in India, 1921-22.

magnitude of the task before it. Paradoxical as it may seem, it is a fact that, India, with her quarter million square miles of forests, still imports timbers!!

Surely the Department which has, in addition to producing a net revenue of 22 million rupees in one year, fostered such flourishing industries as the resin industry, paper-pulp manufacture, match industry and many others, does not deserve to be 'axed."

S. A. VAHID, I.F.S.

THE INTERACTION BETWEEN *PINUS LONGIFOLIA.* *(CHIR)* AND ITS HABITAT IN THE KUMAON HILLS.

III.—THE EFFECT OF THE HABITAT ON THE GROWTH OF THE CHIR.

Just as difficulty is experienced in an analysis of the complex of factors deciding the restriction of the tree to a certain ascertainable distribution, to find out what are the real limiting factors, so also it is no easy task to decide what causes underlie the development and condition of any individual tree or group of trees. That condition can be described, and more or less obvious special features of the site can be noted, but to trace casual connections requires a very large amount of data and often difficult experiment. The forester's custom of distinguishing certain quality classes of locality—'locality' representing the sum of all the physical factors affecting the site of growth, is the result of the realisation that almost the only practical indication of the production capacity of a locality, is the produce. In other words, our knowledge is altogether inadequate to allow us to allot so many points each for altitude, aspect, subsoil, etc., and adding them up, to say the total is a measure of the productive capacity of the locality. The only type of analysis at present possible is that utilised by the writer in an examination of the influence of some of these same factors, on the rate of occlusion of resin channels (Champion[12]) by collecting a large number of data under a variety of conditions so selected that, there is a reasonable chance of cancelling out all variables but the one under examination.

2

In so far as general ocular observation goes, reference may be made to Troup's monograph (Troup[5], pp. 18—20) and the working plans for hill divisions. The essential points are dealt with below, and it has been found almost impossible to deal with the foregoing heads without occasionally including particulars more properly recorded here.

Rock.—As regards underlying rocks, different writers dealing with restricted areas have expressed different opinions as to which is the most favourable to the growth of *chir*, and the reasons for it.

Thus for Kumaon, Smythies[12] (p. 9) considers the tertiary Siwalik formations the best especially the middle Siwalik sand-rock; Osmaston[8] (p. 16) the older gneissic rocks; the present writer[13] (p. 15), limestone under certain conditions. It has however to be realised that the condition and the depth of the soil and subsoil are of much greater importance than the actual rocks below them, and really to a large extent the latter affects the growth only in so far as it is the parent of the soil. Troup[14] (p. 1045) summarising published information, avoids expressing an opinion as to which formation carries the finest *chir*, concurring in this view. Thus when it is asserted that gneiss is best suited to *chir*, what is to be understood is that, gneiss most frequently gives an optimum soil and subsoil. There are considerable grounds for thinking that the physical condition has a much greater effect than the chemical composition, most of the soils in question having a sufficiency of the requisite mineral constituents; this helps to explain the difference of opinion referred to, and the fact that *chir* grows well over a very wide range of rocks. Present opinion may be resummarised to the effect that among the old crystalline and highly metamorphic rocks, gneiss most frequently gives optimum conditions, whilst growth is also very good on the sandstones of the Siwalik formation.

Soil and Subsoil.—It has just been seen that other conditions being equal, the depth and physical condition of the soil and subsoil decide how far *chir* shall thrive in any given spot. It is a relatively deep rooted species, and it requires a reasonable depth in which to develop its root system at all satisfactorily, being able

at the same time to profit from an exceptional depth. It is also easily recognised that a light soil is preferred to a heavy one, and the tree does not thrive on stiff clayey soils such as sometimes occur in flat or poorly sloping places on most rocks. Since this inferiority is recognisable where there is any tendency for water to collect in excess and stagnate, it is clear that the real cause is lack of aeration rather than unsuitability on other grounds. So long as the depth is sufficient a certain degree of stoniness does not appear to have any adverse effect. As regards actual soil moisture, a wide range is permissible without very much visible effect as *chir* of good growth may be found equally among the edge of permanent water streams, and on exposed slopes where the water-supply during the hot weather must be very restricted: but as noted where the water-supply is copious, it must not be at all stagnant.

To summarise, *chir* reaches its optimum development on a light soil of good depth, well drained and reasonably moist.

Aspect.—The direct effect of aspect, apart from the indirect effect working through connected variation in the soil, is again difficult to demonstrate. How far the moisture atmosphere and weaker light on the cooler northern slope balance the relative drought and strong insolation of the warmer southern aspect, cannot even be guessed. The best growth is on the whole found on the more sheltered aspects, but this is likely to be traceable to the soil once more. Possibly the rate of occasion of wounds may be an indication of the relative value to the tree of the several aspects, in which case north is best and south poorest (Champion[12], p. 15).

The heavy mortality which may be occasioned to young plants by a monsoon inadequate in amount or distribution has already been mentioned. The only record of direct injury from drought on older plants comes from a plantation (Champion [9], p. 171).

With its wide distribution in longitude and corresponding considerable variation in general climate especially as regards the amount and seasonal distribution of the rainfall, a variation in the botanical characters of the tree would almost be expected. No such have however yet been recorded.

Extraneous Influences.—The advent of man has interfered with nature's balance both between the locality and the *chir*, and between the *chir* and its competitors. This problem has been dealt with in the note already quoted (Champion) and only the essential facts need be repeated. It is found that by burning the forests, the region which *chir* occupies without competition is extended upwards into the oak, laterally into all shallow ravines and hollows, and possibly also downwards into the sal and miscellaneous forests. At the same time its regeneration is very seriously restricted and injured, and open crops of inferior trees result with a parallel deterioration of the quality of the locality. Considerable areas have been totally disforested and twisted fibre becomes more prevalent. By felling and lopping, the young trees are largely destroyed, whilst excessive grazing and trampling render establishment of new seedlings increasingly difficult, so that this influence works in the same direction as the firing. Intense lopping may result locally in the replacement of *chir* by oak coppice.

IV.—THE EFFECT OF THE CHIR ON THE HABITAT.

On the Soil.—*Chir* shares with other pines, especially with the 2 and 3 needled forms, a rather low relative value as a soil producer. It gives a thick carpet of needles every year and abundant twigs, etc., but the carpet is very slow of decomposition when unmixed with broad leaved litter, and especially when dry. Mixed with oak it decomposes much more rapidly and gives an excellent humus and even the mixture with the low level deciduous species is fairly satisfactory in this respect. Through its excessive inflammability, a covering of *chir* needles exposes the soil to the danger (which commonly materialises) of frequent and severe fires with consequent destruction of undergrowth and humus, and drying out, though these fires return a great deal of the mineral salts to the soil in a readily accessible form, assisting the seedlings commencing growth a month or two later (Champion[15]). When fires do not occur or are excluded, a covering of *chir* undoubtedly improves the soil, especially the light soils on which it thrives best, and to some extent prepares the way for its own exclusion

by a more mesophytic and exacting flora. In such protected forests, the improvement even after the short period of 30—40 years is sufficient to raise the productive capacity of the soil very appreciably; Baldhoti plantation near Almora being a good example of this.

As a colonist occupying newly exposed soil and by covering it, preventing erosion, *chir* is quite good, and seedlings can usually be found on new land-slips, cuttings, etc., where the loose well-aerated soil allows of rapid development.

On Erosion.—The very high importance of the covering of *chir* forests in preventing the rapid erosion of the soil in the hills is very evident in any place where the cover has been removed, as in the vicinity of Almora town. In the latter areas, the heavy monsoon downpours result in very rapid erosion, and the productive capacity is reduced from good to extremely low or nil for agricultural or forest crops in a very short period of time. Conversely, if the devastating run-off is prevented by a soil covering, the moisture is soaked up, and maintains the flow of springs and streams, many of which originate in the *chir* zone. In this connection, the common belief of the Almora populace must be mentioned that the afforestation of the neighbouring hill-tops has resulted in a diminution of the water-flow from the springs. The explanation tendered is simple enough—the *chir* drinks up the water which would otherwise flow from the springs. There are no statistical data to shew the variation in flow, but if there be any basis for the belief, it is probably to be found in the undoubtedly greatly reduced run-off after showers, the check on which is interpreted as indicating a reduction in total outflow. This is not a suitable place for discussing the effect of forests on the total precipitation.

V.—The Effect of Forest Management on the Chir.

A relatively small proportion of the *chir* forests have been under systematic management for some 35 years (a few plantations etc., since 1875), and a much larger area for the last 10—15 years, so there has been time for this new influence to affect the condition of the forests, and the inter-species balance.

Fellings.—Large scale fellings have taken place under the two main systems of forest management, the selection and uniform systems. The former has varied considerably in the details of its execution, but in the main has resulted in the removal of the largest and best trees singly or in groups over large tracts, combined with almost invariably unsuccessful fire protection. These fellings have always been made with a high girth limit, at least 5 ft., and so except over small areas, plenty of trees were left to maintain the general soil cover and restock the gaps formed; hence such fellings have had but little permanent effect on the forest apart from a small reduction in the density and the removal of a number of large over-mature trees. The upset of the balance between reproduction and firing has been more disturbing than the actual fellings.

The results of the introduction of the uniform system have been very different and have had longer to shew themselves. As practiced in Kumaon, the chief difference has been that, whereas the selection system was mainly concentrated on the fellings, the uniform system has given primary attention to the regeneration. The selection fellings have been continued more or less regardless of whether regeneration was being obtained or not whilst for the uniform system, successful fire protection and adequate regeneration have rightly been considered as essential, and to a very satisfactory extent have been attained in the older reservations. The result has been the establishment of abundant regeneration in fairly even-aged groups of varying extent, in the almost entire disappearance of the very large overmature trees of the virgin forests, and in the creation of new type of forest composed entirely of young trees. The changes due entirely to fire protection have been omitted as far as possible, but it must be pointed out that where fire protection has not been successful, and the fellings too drastic, the result has been the more or less complete destruction of the forest *passim* after the 1921 fires; also parts of Khansargadh in Garhwal.

Fire Protection.—But the great change in the growth conditions introduced with forest management has been fire protection. One may assume that from the commencement of their

history, including the period before the advent of man, these forests were subject to occasional fires started by natural causes with intervals of varying length, during which they were not burnt. The forests as we now see them however, must have grown up under much the same conditions as prevail at the present day with annual burning almost invariable—the oldest trees hardly reach 300 years, and 300 years ago Kumaon was practically as thoroughly settled as now. The introduction of fire protection was thus bound to have a very far-reaching influence on the vegetation with all its complex interrelationships. The visible effects on the *chir* forests are the filling up of all gaps and the general closing up of the canopy, the alteration of the stem form from that of the branchy wide-crowned trees typical of open stocked irregular forests, to the tall cylindrical bole and short crown of the tree which has grown up as part of a uniform group or crop.

It is self-evident and generally recognised that in some ways the introduction of fire protection actually increase the danger from fire, in that when from any cause a fire starts in a protected area, the accumulated needles, débris and often grass, give rise to a conflagration incomparably greater and more liable to injure the standing crop than the quiet fire of the annually burnt forest. It is recorded by Jerram[16] (p. 7). In this connection that in certain ranges in the Rawalpindi division, the forests have deteriorated since they came under regular management owing to periodic failures in the fire protection. The hazard is specially felt in newly protected areas where there is always more risk of fires being started by human activities and where often the cover is insufficiently dense to have cleared off all low branches and so restrict the fire to the conditions of a ground fire. At the same time it may be noted that the change is a return to primeval conditions.

It is difficult to analyse out the shares of the fire protection and general protection, on the establishment of undergrowth in *chir* forests, but it is unquestionable that the part played by the exclusion of fire is a very important one.

Subsidiary cultural operations.—All modern working plans prescribed various operations to follow regeneration fellings, and

in the newly established crop, with the object of increasing the quality and uniformity of the latter. These usually begin with clearing up of the felling debris to reduce the fire hazard and improve the seed-bed, and lead up possibly, through sowing up of blanks, to cleanings and thinnings in the young crop ; every one of these operations is intended to, and undoubtedly does influence the growth of the latter. If sowings are made with seed not obtained from the same locality or collected from a type of tree not the prevalent one there, appreciable changes in the crop may occur, since modern research has established that other features in the parent trees may be passed on to their offspring (cf. Champion[17]). The importance of this with regard to twisted fibre is self-evident. It is again obvious that the tending operations in the young crops aiming at the elimination of all inferior stems, and the maintenance of a uniform canopy with optimum spacing for optimum development will also have a vast influence on the average stem in the crop raised by the forester as compared with the naturally grown crop ; this difference is visible after the shortest acquaintance with old and recent reservations.

General protection.—The results of the protection of the forest against all forms of injury have already been touched on and are dealt with in detail in the separate note already referred to. Unaccompanied by adequate management, it may result in a reduction of the area under *chir* by encouraging the establishment of an undergrowth in which *chir* cannot regenerate without assistance : given the necessary management, it helps towards the improvement of the crop from the forester's standpoint.

Resin tapping.—Of recent years the resin value of *chir* has come to outweigh by far its value as a timber produce in the Kumaon forests. Large areas which are totally unproductive as timber give a revenue, and a good one, through their resin and the importance of this product has frequently been the reason for the introduction of modern management, and even their retention as reserves. The resin industry has thus contributed greatly towards the improvement of the forests and a check on the destruction in progress, quite apart from any immediate revenue which may have been produced. On the other hand it must be admitted

that the introduction of resin operations has greatly increased the danger from the greatest menace of all to the continued existence and welfare of these forests, *i.e.*, fire, and the consequences are only too apparent, for, despite its wonderful powers of resistance, a tree bearing several open resin channels separated by narrow strips of living bark cannot be expected to survive a blaze which ignites the channels—as is usually the case. Examples are to be seen everywhere and the danger and damage are greatest for isolated standards among young regeneration, where everything may be killed. On the whole, however, the benefits conferred by the extension of resin work to the hill forests far exceed these drawbacks.

VI.—The Effect of Forest Management on the Habitat.

It is no easy matter to distinguish between the effects of management on the tree growth and on the locality since changes in the latter are usually recognised by the resultant effects on the former. The effects on the tree may thus be twofold—those exerted directly, and those acting through alterations brought about by the changes wrought in the habitat (primarily, the soil) in which it grows.

One of the aims of forest management is always the maintenance of a good soil-cover with inclusion, wherever possible, of trees which add markedly to the humus-content (such as *banj* oak) and, however imperfectly the object is attained, it must tend towards the improvement of the soil. The undoubted improvement of the soil in the Almora plantations already mentioned is good example of this.

As regards the influence in this direction of fire protection annually burnt *chir* forests away from the outer limits of distribution are practically devoid of all undergrowth, whereas protection always results in its establishment in varying degree, the overcrop, except in youth, being always sufficiently open to allow of it. This undergrowth must help towards improving the quality of the soil and so that of the locality though it may act as a hindrance to regeneration. The introduction of general protection acts in exactly the same direction.

VII.—Chir as a Climax Formation.

We have finally to endeavour to forecast the final equilibrium of the reaction between tree and habitat as discussed in the foregoing paragraphs. It has been made clear that the destructive propensities of mankind have told heavily in the past, and are still doing so, on the *chir* forests, but that, the introduction of modern forestry methods is again turning the scale by doing all possible to encourage the species. The question accordingly comes up as to where the new equilibrium is likely to be. Would these forests now being protected from injurious external influences remain under *chir* without selective assistance against other species? If we do nothing more than protect, will other species find entry and oust the *chir?* In other terms, is *chir* forest the climax formation for these areas, the highest form of vegetation they can support? It has been brought out that all these influences act as dessicating agents, and, if they are checked, there is at once an initiation of a progression to a deeper or moister soil.

As regards the broad-leaved formation adjoining *chir* at low elevations, given such protection, *chir* seems likely to retreat before sal and the more mesophytic forms of the mixed deciduous forest, and to be usually only a stage towards them for the more xerophytic forms, though occasionally, it may be the climax for these last. At the upper elevations and in sheltered localities configuration has an important influence, and one reaches the decision that the oak, etc., will extend their range downwards quite appreciably, except where the erosive action of the rainfall on the soil ensures the maintenance of soil conditions too poor and shallow to enable them to oust the better adapted *chir.* A similar condition holds for sheltered hollows, and in both places *chir* instead of being a climax is only a stage towards a broad leaved forest.

The indications on the whole are then, that there is a limit to progress in this direction and that no other species is likely to displace *chir* from the central parts of its range, without a fundamental alteration in climate, *i.e.*, for these *chir* must be considered the climax formation.

H. G. Champion, I.F.S.

References to Literature.

1. H. Mayr, Wald und Parkbaume. 1906.

2. E. Warming, Oecology of Plants, Eng. Tr., 1909, pp. 310—316.

3. M. C. Stopes, New Phytologist, 1907, pp. 46—50.

4. A. F. W. Schimper, Plant Geography on a Physiological Basis, Eng. Tr., 1903, p. 564.

5. R. S. Troup, *Pinus longifolia*, Roxb , Ind. For. Memoirs 1916.

6. A. E. Osmaston, Ind. For., 1914, pp. 387—391.

7. A. J. Ewart, Phil. Tr., Roy. Soc., London, 1905, B. P., 52,

8. A. E. Osmaston, Working Plan for the North Garhwal Division, 1921.

9. C. F. C. Beeson, Ips. longifolia, Steb., as a pest of *chir* regeneration areas, Ind. For., 1915, pp. 318—325. Forest Insect Conditions in India, Agric. Jourl., Ind, Sci. Congr., 1918, p. 120.

10. H. G. Champion, Ind. For., 1922, pp. 168 and 232.

11. H. G. Champion, The Influence of the Hand of Man on the distribution of forest types in the Kumaon Himalaya, Ind. For., 1923, pp. 116—135.

12. E. A. Smythies, Working Plan for the Naini Tal Division, 1915.

13. H. G. Champion, Working Plan for the Central Almora Division, 1921.

14. R. S. Troup, Silviculture of Indian Trees, III, 1921.

15. H. G. Champion, Observations on some effects of fires in the Chir (*Pinus longifolia*) forests of the West Almora Division, Ind. For., 1919, 353—364.

16. M. R. K. Jerram, Revised Working Plan for the Forests of the Murree and Kahuta Ranges, Rawalpindi Division, 1915.

17. H. G. Champion, Contributions towards a knowledge of Twisted Fibres in Trees (M/SS).

A NOTE ON SOUTH INDIAN LORANTHACEÆ AND THEIR HOST PLANTS.

The present note is the outcome of a study which the writer was induced to make two years ago during the course of his investigations into the cause of "spike" in sandal (*Santalum album*) with the object of finding out to what extent similar phenomena resembling spike occur in the case of *Loranthaceous* parasites. In the papers already published[1] it was pointed out that spike in the case of sandal is due to insufficiency of water to the plant owing to the death or removal of hosts or their otherwise being unfavourable. The study of *Loranthaceæ* was begun from this point of view, but for various reasons field observations of an extended nature could not be made and the writer had to confine his attention to the material existing in the herbarium at Coimbatore. The collection of *Loranthaceæ* here is specially valuable as host plants have been recorded in the majority of instances, a procedure which may sometimes be neglected by systematic collectors. Examination of the material yielded the list of hosts and their parasites which are recorded below and some tentative conclusions have been arrived at which will later be subjected to further proof.

Evidence for spike.—Among the species of *Loranthus* examined *L. cuneatus* and *L. longiflorus var falcata* gave indications of spike (*vide* figs. 1—4). In the case of the other species evidence was not so decisive as herbarium material could not provide 'diseased' or abnormal specimens in all cases. The actual death or removal of hosts does not arise in the case of *Loranths* as with sandal as the former attack perennial trees and shrubs which are not entirely killed by the parasite. The conditions

Fig. 1.

Fig. 2.

Loranthus cuneatus on 1. *Sophora glauca*, 2. *Dodonea viscosa*

Fig. 3.

Photos by M. S. Royan.

Fig. 4.

Loranthus longiflorus var. *falcata* on 1. *Azadirachta indica*, 2. *Albizzia amara*.

common to both which may lead to spike are the unsuitability of hosts and it is known in the case of the *Loranths* that the hosts undoubtedly exert an influence on the size and colour of leaves in the parasite so much so that the leaves fail to help in the identification of species. On this point[2] Koernicke in his valuable paper, "Biologische Studien an Loranthaceen," writes as follows:—

"........* der Wirt einen spezifischen Einfluss auf die Ausbildung des ihn befallenden Parasiten ausubt, sodass man "ernahrungs-physiologische Arten oder Rassen"' bezw. "Standort Varietaten" unterscheidet. So findet sich denn auch bei den javanischen Loranthaceen ein je nach der Wirtspflanze, vielleicht auch den Gegenden, oft ausserordentliches Schwanken im ausseren Habitus (Strauchausbildung, Blattgrosse,—Form und—Farbe), sodass, wenn nicht Bluten und Fruchte auf die Zugehorigkeit zu einer bestimmten Art hinwiesen, man versucht ware, wie es auch 'verscheidentlich geschah, neue Arten aufzustellen. Besonders "polymorph" sind nach Korthals bezw. Miquel ferner Molkenboer Viscum orientale, Viscun articulatum, Loranthus pentandrus."

Host plants.—An account of *Loranthaceæ* occurring in the Neilgherries was furnished by Bidie in 1874. The *Loranths* of Coimbatore District together with the hosts attacked by them formed the subject of a note by Fischer[3] in 1907 who also read a paper at the last Science Congress on the *Loranthaceæ* of South India which does not appear to have been published till now.[4] Mr. Fischer announced his list to contain 23 species with 6 varieties attacking 218 hosts, which must be a valuable contribution to the subject. The list appended below contains 68

* ...... the host is known to exercise a specific influence on the growth of the parasite, so here also one may have to distinguish local varieties, due to physiological changes due to nutrition, from real species or races.

In the Javanese *Loranthaceæ* one finds extraordinary variations in the external habit (changes of shape of shrub, size of leaves, form and colour) entirely due to the particular host, and also possibly to the district. These variations would often cause one to posit new species, except when the flowers or fruit point clearly to some definite species, indeed this confusion has already happened.

According to Korthals, Molkenboer and especially Miquel, *Viscum orientale Viscum articulatum*, *Loranthus pentandrus* are especially polymorphous. (Translated.)

hosts affected by 20 species to which may be added the following hosts observed by the writer some of which have been recorded by either Fischer or Koernicke.

Viscum sp. on *Thespesia populnea*, *Erythroxylon monogynum*, *Grewia tiliaefolia*, and *Loranthus* sp. on *Nyctanthes Arbor-tristis Odina Wodier*, *Euphorbia antiquorum*, *Phyllanthus Emblica Eucalyptus amygdalina*, *Salix babylonica*, *Aegle Marmelos*, *Citrus Aurantium* and *Casuarina equisetifolia*.

Affinity between Loranthaceæ and Santalaceæ.—Attention may be drawn to the fact that of the 68 hosts recorded in the list 19 are attacked by *Santalum* also by means of its roots *(vide* Appendix B). The same hosts being subject to the attack of *Loranthaceous* parasites on the one hand and of sandal on the other suggests in the first place a physiological affinity probably of an osmotic nature (cf. Harris and Lawrence)[5] between the parasites *Viscum*, *Loranthus* and *Santalum* and their susceptible hosts; and, secondly, a nearness of physiological relationship between the two parasitic families, *Santalaceæ* and *Loranthaceæ*, which on other grounds have been placed together in the systems of classification drawn up by Engler-Prantl and Bentham-Hooker.[6] The statistical evidence for this assumption may be briefly stated as follows:—

1. Taking Mr. Fischer's list of 1907 also into account the total number of families attacked by *Loranthaceæ* is 43 *(vide* Appendix C), out of which 30 are susceptible to *Santalum* also, according to the valuable list of hosts of sandal published by Rama Rao (1900),[7] who has incorporated that of Barber (1907).[8] It may be observed that of the remaining 13 the plants belonging to *Lineæ*, *Melastomaceæ* and *Elæagnaceæ* are stated as associates of sandal (which are probably attacked), and some of the others, *e.g.*, *Rhizophoreæ*, *Berberideæ*, *Rhododendron* and *Ilex* are of restricted distribution. Fischer's later list of 218 hosts, still unpublished, may throw further light on this point.

2. The number of hosts recorded by Rama Rao for sandal is 142 (excluding two unnamed ones), and these belong to 50 natural orders, of which 30 are attacked by *Loranths*. Of the

Fig. 5.
Viscum monoicum and *V. ramosissimum* on *Santalum album.*

Fig. 6.
V. monoicum and *V. articulatum* on *Santalum album.*

Fig. 9.
Loranthus loniceroides on *Ficus religiosa* showing phyllody.

Fig. 7.
Viscum angulatum on *Opilia amentacea.*

Photos by M. S. Royan.

Fig. 8.
V. japonicum on *Eurya japonica.*

remaining 20 it may be seen that 5 are among monocotyledons, and of the rest the *Begonias, Cucurbitas, Tinospora* (*Menispermaceæ*), *Asclepiadaceæ*, *Amarantaceæ* cannot for obvious reasons be parasitised by the *Loranthaceæ.* On the evidence so far available it appears that *sandal can attack several hosts which are affected by Loranthaceæ, though the converse is not true to the same extent.* The above figures and those for the genera and species are given in the following table ;—

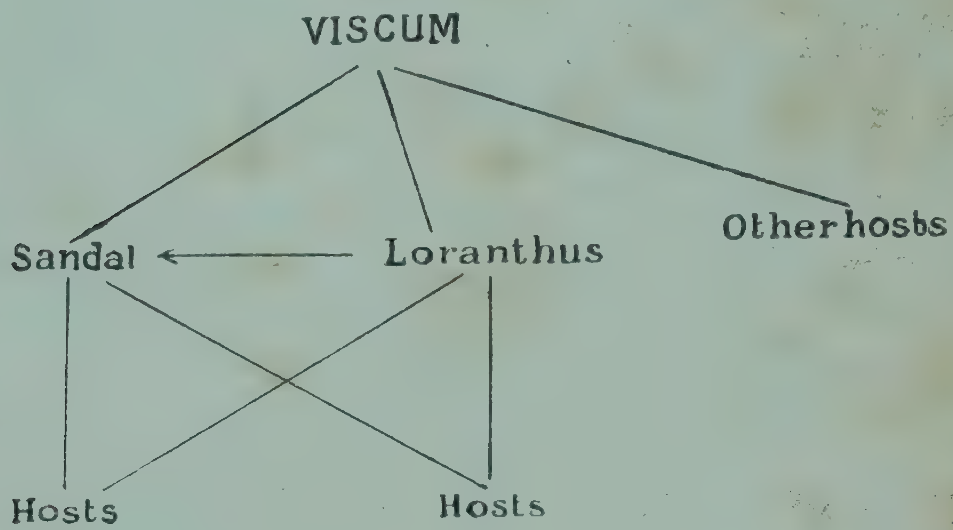
Number of Hosts attacked by

	Sandal alone.	Sandal and Loranthaceæ.	Loranthaceæ alone.	Total.
Families ...	20	30	13	63
Genera ...	87	30 (plus 15 ?)	46 (−15 ?)	163
Species ...	109	35 (plus 15 ?)	63 (−15 ?)	207

Viscum on Sandal.—The affinity suggested is also seen in sandal being parasitised by *Viscum.* Two specimens of special interest collected from Mysore (Somnathapur) have been noticed (*vide* figs. 5—6) in which the same twig of sandal has been attacked by *Viscum monoicum* and *V. ramosissimum* (the former towards the top) in one case and in the other by *V. monoicum* and *V. articulatum.* Rama Rao (1918) (9) noticed *V. verruculosum* and *Loranthus tomentosus* on sandal. The damage to sandal from *Viscum* or *Loranthus* is probably very little now, but it is suggested that the super-parasites may be kept in check and prevented from spreading.

Double parasitism.—This has been recorded by Fischer [10] for *V. capitellatum* on *L. tomentasus* and *L. longiflorus.* Among the specimens examined by the writer were *L. cuneatus* on *L. neelgherrensis* and *V. capitellatum* on *L. longiflorus var falcata* which was parasitic on *Salvadora persica.* Similar observations have been recorded in the case of some foreign *Loranthaceæ. Phoradendron californicum* for instance has been noticed on *P. flavescens* by Brown[11] (America), who suggests osmotic superiority for the former. Koernick's paper contains other instances.

The following scheme represents the parasitic relationship that exists among the genera *Viscum*, *Loranthus* and *Santalum* and their numerous hosts.



Phyllody.—Phyllody in *spiked trees* of sandal was first noticed by Barber (1903)[12] who characterised it as "one of the most puzzling parts of the disease." Among the *Loranthuses* examined the writer's attention was arrested by a fortunate specimen of *L. loniceroides* parasitic on *Ficus* Sp: collected by Rangachariar (1910), (*vide* Fig. 9) the word "phyllody" being written on the sheet. In view of the importance attached to the phenomenon by Barber, Butler (1903) and Coleman (1917) in the discussion bearing on the subject of spike in sandal, its occurrence in *Loranthaceæ*, whatever its cause, might prove to be of some interest.

I have to thank Rai Bahadur K. Rangachariar Avl. for special facilities extended in examining the herbarium collections.

P. S. JIVANNA RAO, M.A.

SANTALUM ALBUM, LINN. IN THE CHITOOR DISTRICT.

Appendix A.

Parasites.	*Hosts.*
1. Loranthus wallichianus...	Cinnamomum Wightii.
2. L. intermedius ...	Cinnamomum zeylanicum.
3. L. obtusatus ...	Rhododendron arboreum.
4. L. scurrula ...	Dalbergia lanceolaria, Viburnum erubescens, Ligustrum neilgherrense, Vitex Negundo, Eleaagnus latifolia.
5. L. tomentosus ..	Desmodium rufescens, Acacia dealbata, Litseaa zeylanica, Viburnum erubescens.
6. L. recurvus ...	Eleaagnus latifolia, Glochidion sp.
7. L. cuneatus ..	Atalantia monophylla, Balsamodendron Berryi, Opilia amentacea Scutia indica, Dodoneaa viscosa, Sophora glauca, Acacia Melanoxylon, Wendlandia Notoniana, Ligustrum Roxburghii, Loranthus neelgherrensis, Glochidion tomentosum.
8. L. longiflorus ...	Balsamodendron Berryi, Lansium sp., Cassia siamea, Rhizophora sp., Gyrocarpus Jacquini, Bassia longifolia, Tectona grandis, Artocarpus integrifolia.
L. longiflorus var falcata,	Protium caudatum, Azadirachta indica, Zizyphus glabrata, Dalbergia spinosa, Dichrostachys cinerea, Acacia Suma, A. ferruginea, Albizzia amara, Salvadora persica, Stereospermum sp., Tectona grandis, Gyrocarpus Jacquini, Punica Granatum.
L. longiflorus var bicolor,	Acacia amara.

Parasites.		*Hosts.*
9. L. elasticus	...	Thespesia populnea, Citrus sp., Mangifera indica, Punica Granatum, Lantana sp., Myristica fragrans, Manihot Glaziovii, Ficus bengalensis.
10. L. neelgherrensis	..	Berberis aristata, Acacia Melanoxylon, Viburnum coriaceum, Viburnum erubescens, Ligustrum Roxburghii.
11. L. memecylifolius	...	Rhamnus Wightii, Daphniphyllum glaucescens, Rhododendron arboreum, Myrsine capitellata.
12. L. loniceroides	...	Eurya japonica, Acacia Melanoxylon, Terminalia tomentosa, Myrsine capitellata, Cinnamomum Wightii, Litseaa zeylanica, Ficus religiosa.
1. Viscum monoicum	...	Pongamia glabra, Albizzia amara, Punica Granatum, Wrightia tinctoria, Santalum album.
2. V. orientale	...	Helicteres Isora.
3. V. orbiculatum	...	Punica Granatum.
4. V. capitellatum	...	Rhizophora, Loranthus longiflorus var falcata.
5. V. ramosissimum	...	Rhus mysorensis, Santalum album.
6. V. angulatum	...	Opilia amentacea, Zizyphus xylopyrus.
7. V. articulatum	...	Diospyros Melanoxylon, Santalum album.
8. V. japonicum	...	Rhododendron arboreum, Eurya japonica, Ilex Wightiana, Ilex denticulata.

Appendix B.

F.-Fischer ; K-Koernicke; J-Author, S-attacked by Santalum also.

Natural Orders.	*Hosts.*	*Parasites.*
I. BERBERIDEÆ.		
	1. Berberis aristata ...	L. neelgherrensis.
II. TERNSTROEMIACEÆ.		
	2. Eurya japonica ...	L. loniceroides, V. japonicum.
(F) III. DIPTEROCARPEÆ (Shorea Talura)		
IV MALVACEÆ.		
	S. 3. Thespesia populnea,	L. elasticus.
V. STERCULIACEÆ.		
	4. Helciteres Isora ...	V. orientale, V. sp.
F & J. S. VI. TILIACEÆ (Grewia tiliæfolia).		
F & J, S. (?)VII. LINEÆ (Erythroxylon monogynum).		
VIII. RUTACEÆ		
	S. (?) 5. Atalantia monophylla ...	L. cuneatus.
	S 6. Citrus Aurantium ...	L. elasticus.
IX. BURSERACEÆ.		
	7. Balsamodendron Berryi ...	L. cuneatus, L. longiflorus.
	S. 8. Protium caudatum ...	L. longiflorus var falcatus.
X. MELIACEÆ.		
	9. Lansium sp. ...	L. longiflorus.
	S. 10. Azadirachta indica ...	L. longiflorus var falcatus.
XI. OLACINEÆ.		
	11. Opilia amentacea ...	L. cuneatus, V. angulatum.
XII. ILICINEÆ.		
	12. Ilex Wightiana ...	V. japonicum.
	13. Ilex denticulata ...	V. japonicum.
XIII. RHAMNEÆ.		
	S (?) 14. Scutia indica ...	L. cuneatus.
	15. Zizyphus glabrata ...	L. longiflorus var falcatus.

Natural Orders.	*Hosts.*	*Parasites.*
S (?)	16. Zizyphus xylopyrus ...	V. angulatum.
	17. Rhamnus Wightii ...	L. memecylifolius.
XIV. SAPINDACEÆ.		
S (?)	18. Dodoneaa viscosa ...	L. cuneatus.
XV. ANACARDIACEÆ.		
	19. Rhus mysorensis ...	V. ramosissimum.
S.	20. Mangifera indica ...	L. elasticus, L. sp.
XVI. LEGUMINOSÆ.		
S (?)	21. Dalbergia lanceolaria ...	L. scurrula.
	22. Dalbergia spinosa ...	L. longiflorus var falcatus.
	23. Desmodium rufescens ...	L. tomentosus.
S.	24. Pongamia glabra ..	V. monoicum.
	25. Sophora glauca ...	L. cuneatus.
S.	26. Cassia siamea ...	L. longiflorus.
	27. Dichrostachys cinerea ...	L. longiflorus var falcatus.
	28. Acacia dealbata ...	L. tomentosus.
	29. „ Melanoxylon ...	L. recurvus, L. neelgherrensis, L. loniceroides.
S.	30. „ Suma ...	L. longiflorus var falcatus.
S.	31. „ Intsia ...	L. sp., L. sp.
S (?)	32. „ ferruginea ...	L. longiflorus var falcatus.
	33. „ amara (?) ...	L. longiflorus var bicolor.
S.	34. Albizzia amara ...	L. longiflorus var falcata, V. monoicum.
XVII. RHIZOPHOREÆ		
	35. Rhizophora sp. ...	L. longiflorus, V. capitellatum, V. sp.
XVIII. COMBRETACEÆ.		
	36. Gyrocarpus Jacquini ...	L. longiflorus, L. longiflorus var falcatus.
	37. Terminalia tomentosa ...	L. loniceroides.
F. & J. XIX. MYRTACEÆ.		
(F) S (?) XX. MELASTOMACEÆ (Memecylon edule).		

Natural Orders.	*Hosts.*	*Parasites.*
XXI. LYTHRACEÆ.		
	38. Punica Granatum	L. longiflorus var falcatus, L. elasticus, L. sp., V. monoicum, V. orbiculatum.
XXII. CAPRIFOLIACEÆ.		
	39. Viburnum coriaceum var capitellata.	L. neelgherrensis.
	40. Viburnum erubescens	L. scurrula, L recurvus, L. neelgherrensis.
XXIII. RUBIACEÆ.		
	41. Wendlandia Notoniana	L. cuneatus.
XXIV. ERICACEÆ.		
	42. Rhododendron arboreum	L. obtusatus, L. memecylifolius, V. japonicum.
XXV. MYRSINEÆ.		
	43. Myrsine capitellata	L. memecylifolius, L. loniceroides.
XXVI. SAPOTACEÆ.		
	S. (?) 44. Bassia longifolia	L. longiflorus.
XXVII. EBENACEÆ.		
	S. (?) 45. Diospyros Melanoxylon	V. articulatum.
XXVIII. OLEACEÆ.		
	46. Ligustrum neelgherrense	L. scurrula.
	47. Ligustrum Roxburghii	L. cuneatus, L neelgherrensis, L. sp.
XXIX. SALVADORACEÆ.		
	48. Salvadora persica	L. longiflorus var falcatus.
XXX. APOCYNACEÆ		
	S. 49. Wrightia tinctoria	V. monoicum.
(F) XXXI. S. BORAGINEÆ (Cordia.)		
XXXII. BIGNONIACEÆ.		
	50. Stereospermum sp.	L. longiflorus var falcatus.
XXXIII. VERBENACEÆ.		
	S. 51. Vitex Negundo	L. scurrula.
	S. 52. Lantana Camara	L. elasticus.
	S. 53. Tectona grandis	L. longiflorus, L. longiflorus var falcatus.

Natural Orders.	*Hosts.*	*Parasites.*
XXXIV. MYRISTICACEÆ.		
	54. Myristica fragrans ...	L. elasticus.
XXXV. LAURINEÆ.		
	55. Cinnamomum zeylanicum	L. intermedius.
	56. Cinnamomum Wighti ...	L. wallichianus, L. loniceroides.
	S. 57. Litsea zeylanica ...	L. tomentosus, L. loniceroides.
XXXVI. ELEAGNACEÆ,		
	58. Elæagnus latifolia .	L. scurrula, L. recurvus.
XXXVII. LORANTHACEÆ.		
	59. Loranthus neelgherrensis	L. cuneatus.
	60. Loranthus longiflorus var falcatus.	L. sp., V. capitellatum.
XXXVIII. SANTALACEÆ.		
	S. 61. Santalum album ...	V. monoicum, V. ramosissimum, V. articulatum.
XXXIX. EUPHORBIACEÆ		
	62. Glochidion tomentosum ...	L. cuneatus.
	63. Glochidion sp. ...	L. recurvus.
	64. Daphniphyllum glaucescens	L. memecylifolius.
	65. Manihot Glaziovii ...	L elasticus.
XL. URTICACEÆ.		
	S. 66. Artocarpus integrifolia	L. longiflorus, L. sp.
	S. 67. Ficus bengalensis ...	L. elasticus.
	S. 68. Ficus religiosa ..	L. loniceroides.
K. & J. S. XLI. CASUARINACEÆ (Casuarina equisetifolia).		
K. & J. XLII. SALICINEÆ (Salix babylonica).		

APPENDIX C.

FAMILIES AFFECTED BY

Sandal.	*Sandal and Loranthaceæ.*	*Loranthaceæ alone.*
Anonaceæ ...	Malvaceæ ...	Berberideæ.
Menispermaceæ ..	Sterculiaceæ ...	Ternstroemiaceæ.
Cappărideæ ...	Tiliaceæ ...	Dipterocarpeæ.
Geraniaceæ ...	Rutaceæ ...	Lineæ.
Celastreæ ...	Burseraceæ ...	Ilicineæ.
Simarubeæ ...	Meliaceæ ..	Rhizophoreæ.
Samydaceæ ...	Olacinæ ...	Melastomaceæ.
Cucurbitaceæ ...	Rhamneæ ...	Lythraceæ.
Begoniaceæ ...	Sapindaceæ ...	Caprifoliaceæ.
Cacteæ ...	Anacardiaceæ ...	Ericaceæ.
Araliaceæ ...	Leguminosæ ..	Myristicaceæ.
Cornaceæ ...	Combretaceæ ...	Elæagnaceæ.
Asclepiadeæ ...	Myrtaceæ ...	Loranthaceæ
Acanthaceæ ...	Rubiaceæ ...	
Amarantaceæ ...	Myrsineæ ...	13
Haemodoraceæ ...	Sapotaceæ ...	
Amaryllideæ ...	Ebenaceæ ...	
Palmeæ ...	Oleaceæ ...	
Cyperaceæ ...	Salvadoraceæ ...	
Gramineæ ...	Apocynaceæ ...	
20	Boragineæ ...	
	Bignoniaceæ ...	
	Verbenaceæ ...	
	Laurineæ ...	
	Santalaceæ ...	
	Euphorbiaceæ ...	
	Urticaceæ ...	
	Casuarinaceæ ...	
	Salicineæ ...	
	29	
	Liliaceæ (K) ...	
	30	

REFERENCES TO LITERATURE.

1. Indian Forester, 1920.
   Indian Forester, 1921.
2. Koernicke—Ann: du Jardin Botanique de Buitenzorg, 1910.
3. Fischer—Report on the Neilgherry Loranthaceous parasitical plants, Ind. For., 1907.
4. Fischer—Abstract of papers, Ind. Sci. Congress, 1922
5. Harris and Lawrence—Osmotic pressure in parasite and host. Review in "Bot. Gazette," 1917 (2), p. 345.
6. Engler—Prantl-Die naturlichen pflanzen-familien. Bentham Hooker-Genera plantarum.
7. Rama Rao—Ind. For. Records, 1910.
8. Barber—Mem. Dept. Agric., Ind. Bot. Ser., Vol. I, 1907.
9. Rama Rao—Ind. For., 1918.
10. Fischer—Ind. For., 1907.
11. Brown—"Bot. Gazette," 1918.
12. Barber—Ind. For., 1903.
13. Barber and Butler—Ind. For., 1903—Coleman—Appendix ser. Spike disease of sandal. Mysore Agric. Dept. Bull., 1917.

SANTALUM ALBUM, LINN IN THE CHITTOOR DISTRICT.

Under the above heading a short note was published on pages 32 to 34 of the issue of the *Indian Forester* for January 1922. I have now again visited the scene of the experiment at Horsleykonda therein referred to.

I may recapitulate here that a number of sandal saplings growing on a tank bund, built up on sheet rock, were completely isolated from all other growth in September 1919, with the object of ascertaining how long they could survive without host plants. The whole bund has been kept clean weeded ever since, so that it is certain that the saplings cannot be parasitising any other vegetation, and they have been in that condition for nearly four years.

About July last year it was reported that the saplings under observation were showing signs of degeneration through this deprivation, and so I was anxious to see them again.

I now find that plants certainly have not the same healthy appearance; the leaves are narrower and are not bright green and many of the branchlets and twigs have dried up. But I cannot agree that this is unquestionably due to the saplings being deprived of hosts of other species, as I believe that their present condition is due mainly to the very severe drought of last year. From their very position these individuals are particularly exposed to suffer from drought, when the water level in the tank shrinks to almost nothing, as it did in the hot weather of 1922. This the photos accompanying my note quoted will show. Since recent rain several of the saplings have produced new leaves from the stems and close to the ground; these new leaves have a quite healthy appearance. Further, a very large proportion of the sandal trees in the neighbourhood, even though located in more favourable moisture conditions and among suitable hosts, exhibit similar tokens of distress. In fact, it is practically only those in the most favourable conditions for obtaining moisture that appear really healthy. Another point is that, as the photographs show, the subjects of the experiment are growing far too close, and this alone would account for some of the discomfort.

I send this note now as it is improbable that I shall ever visit the experiment again, but I hope it will be continued to a definite conclusion and that the final result will be communicated to the *Indian Forester*.

In conclusion I may mention that all the seedlings, from seeds experimentally sown on the bare portions of the tank bund, but three have now died, and that there is no sign of ' spike ' among these experimental plants or any other sandal in the locality.

C. E. C. FISCHER, I.F.S.

BURMA FOREST SCHOOL.

PRIZE DISTRIBUTION AT PYINMANA.

The annual prize distribution took place at the Burma Forest School, Pyinmana, at 8 A.M. on Thursday, May 3rd. The proceedings were of more than ordinary interest, in that they

were attended by the Hon'ble Minister for Forests, Mr. J. A. Maung Gyi, and the Hon'ble Minister for Education, U Maung Gyee, who both came down specially from Maymyo. In addition to the two Hon'ble Ministers the following officers took their seats on the daïs :—Mr. F. A. Leete, C.I.E., Chief Conservator of Forests ; Mr. F. W. Collings, Conservator of Forests, Sittang Circle ; Mr. C. H. Philipp, Conservator of Forests, Utilisation Circle ; Mr. H. R. Blanford, O.B.E., Conservator of Forests, Hlaing Circle and Silviculturist, Burma ; Mr. A. P. Davis, Deputy Conservator of Forests, Tharrawaddy Division ; Mr. A. W. Moodie, O.B.E., Deputy Conservator of Forests, Delta Division, and Mr. V. H. T. Fields-Clarke, Deputy Conservator of Forests and Director, Burma Forest School. The Hon'ble Home Member Mr. Maung Kin and the Director of Public Instruction, Mr. C. A. Snow, were unfortunately prevented from being present at the proceedings.

The proceedings were opened by the Director, Mr. V. H. T. Fields-Clarke, with the following address :—

MR. MAUNG GYI, MR. LEETE, LADIES AND GENTLEMEN,—Before proceeding to give you a report on the School for the past year I must first, on behalf of the School, extend a very hearty welcome to the Hon'ble Mr. Mg. Gyi for taking the first opportunity, since his appointment as Minister of Forests, of attending our annual prize-giving. We feel assured that with such a sympathetic Minister our future welfare is in safe hands. I would also, on behalf of the School, offer a warm welcome to the Hon'ble U Mg. Gyee, Minister for Education.

To-day is the 10th prize day since the establishment of the School at Pyinmana and the 22nd since the School first opened in Tharrawaddy.

Both classes complete to-day their two years course of training, the greater part of which has been undergone in the forests—7 months out of each 12 having been spent in the jungle or on tour. Every effort has been made to make the instruction as practical as possible, and I hope the outgoing students will always remember that in the attainment of actual results an ounce of practice is worth a ton of theory.

The English class now passing out opened with 20 students, including 2 students deputed by the Government of Siam. Of these, however, 3 were removedat the end of the first lecture term and 3 at the end of their first year for insufficient progress and general inability to follow the course. This certainly indicates that the existing method of selection and training before deputation to the School is in need of revision, and the question has already been brought before the Board of Control. One student unfortunately died. Of the remaining 13 students (including 2 Siamese) 12 have obtained certificates, 2 (including 1 Siamese) with honours. These students become Forest Rangers, VI grade from the date of their departure from the School.

The Vernacular class started with 18 students. There have been no removals or other casualties. All have obtained certificates, 4 with honours.

The average number of honours certificates awarded annually in the past has been 2 in the English class and 4 in the Vernacular class.

An interesting point in connexion with the marks obtained by students of the 2 classes—English and Vernacular—is that on the whole the Vernacular students have obtained better marks than the students of the English class—68 per cent. as against 65 per cent. to be exact, and this superiority is, I think I am correct in saying, confirmed by Divisional Forest Officers who have had experience of the work of past students of both classes as practical foresters. This is also a matter for serious consideration.

In the matter of conduct and discipline the students have, with one or two petty exceptions, shown exemplary behaviour and the high traditions of the School for gentlemanly conduct and the formation of character—traditions which must be guarded jealously have been fully maintained.

Sports and games have, as in the past, occupied a good deal though not, I think, in view of the importance of physical fitness an undue proportion of the students' leisure hours during the terms spent in Pyinmana. Instead of $1\frac{1}{2}$ or $1\frac{1}{4}$ hours' physical

drill 3 days a week, there was half-an-hour's physical drill every morning from 6-30 to 7 A.M. and one hour's squad drill every Wednesday afternoon. No student was ever seen walking to an early morning lecture in his sleep! Football still is—as I think it should be—the most popular game and the innovation introduced last year by Mr. Lindsay Smith was developed and a competition of 6 teams of 11 aside was carried through successfully. As there were only 80 students in the School all told, it will be seen that there were very few, if there were any, who did not play in the competition, the competition was won by the Virginians led by Saw Wellington. The School team under the captaincy of Mg. Sein was probably a good average one. Of outside matches played 3 were won, 3 lost, and 3 drawn. The team would without doubt have been a better one had it been possible to arrange more outside matches, but after all a comparatively large number of students playing each to the best of his ability is more to be desired than a select number of brilliant athletes. Tennis, which started and prospered under the eagle eye of Mr Philipp, has increased in popularity. There were more than 40 players, and the extra court is more than ever necessary. Now that the best site has been definitely decided on, it will be started. The tournament was held as usual. The singles were won by Saw Wellington and the doubles by Saw Wellington and Mg. San Aung. Mr. Lindsay Smith, to whom the School is very greatly indebted for the time he devotes to the students' sports and games, continued his gymnastic classes and as many students as he could look after 16 formed a gymnastic class which was held 3 days a week. The gymnastic competition was won by Mg. Tun Myat, 1st and Nai Theankee, 2nd. The athletic sports were held at the end of September. There were numerous entries and the events were keenly contested. In 4 events out of 7 the timings of last year were beaten. The prize for the best athlete was won by Mg. Kha, a 1st year student, who took 4 first prizes. The 2nd year students, it may be noticed, were less successful than the 1st year, the latter carrying off 14 prizes as against the 8 won by the 2nd year. The Marathon Race over a 10-mile course was run on the 2nd October. Forty students started and 28 finished the course, 14 of the latter finished within the

allotted time limit of $1\frac{1}{2}$ hours. The winner, Maung Ba Thwin's time was 1 hour 19 minutes, 1 minute better than last year.

As regards health it must be stated that the year was a particularly unhealthy one. I regret to have to record that one 2nd year student died of pneumonia and one 1st year student of enteric during the year. The late rain in November-December was, doubtless, chiefly responsible for this large amount of sickness. The fact that forest officers have to be out in the jungles at all times of the year, often in remote places, makes it very necessary that they should have some knowledge of and ability to deal with cases of illness or injury. The 2nd year students were accordingly given the usual course in First Aid and Bandaging. Out of 30 students who went up for the subsequent examination 29 have obtained the certificate of the St. John Ambulance Association.

I think I have now covered all the activities of the School which are of general interest. I should, however, like to take this opportunity of thanking the staff for the efficient and willing help they have given me. In this connexion it is with great regret that we have to bid farewell to U. Kyaw, who is leaving the School to take over charge of the Allanmyo Division. I have known U. Kyaw personally for many years, and can testify to the loyal and willing service he has given at all times. I am sure we all wish him every success. I should also like to take this opportunity of thanking the Divisional Forest Officers of the Divisions in which the practical work of the School is done—in particular Mr. Shirley—whose guests we most often are, but also Mr. Barrington, Mr. Kavanagh, Mr. Davis and Mr. Cheyne who have all taken a great deal of trouble to make the School's tours in their charges not only instructive but as pleasant as possible. The oral examiners I would also thank for the patient manner in which they conducted the oral examinations. Finally, if I may be allowed a personal remark, I would like to record the very considerable debt I am under to Mr. Philipp and Mr. Blanford for the help and advice, official and unofficial, for which I have often asked and which they have always given.

I will now ask you, Sir, to distribute the certificates.

The certificates were then distributed by Mr. F. A. Leete, Chief Conservator of Forests.

The following list shows the students in order of merit out of the School :—

ENGLISH CLASS.

Higher Certificate with Honours.

1. Mg. Kyaw Zan ... P. D. R. ... Minbu Division.
2. Nai Thean Kee ... Siamese Student.

Higher Certificate.

3. Mg. Tha Yan ... D. R., II grade... Mu Division.
4. Nai Thong Kham, Siamese Student.
5. Mg. Thin ... P. D. R. ... Pyinmana Division.
6. J. Paul. ... Do ... South Toungoo Division.
7. Mg. Aung Gyi Sein. Do. ... South Tenasserim Division.
8. A. G. Hottinger... Do. ... Thaungyin Division.
9. Mg. Sein ... Do. ... Mu Division.
10. Mg. On Pe ... Do. ... Bhamo Division.
11. Mg. Po Min ... Do. ... Mu Division.
12. J. Mya U ... Do. ... North Toungoo Division.

VERNACULAR CLASS.

Lower Certificate with Honours.

1. Mg. Ba Than, Stipendiary Student, School Division.
2. Mg. Ba Sein, Hd. Forester, I grade, Tharrawaddy Division.
3. Mg. Tun Mya, D. R., III grade, Prome Division.
4. Mg. Myit, D. R., III grade, Henzada Division.

Lower Certificate.

5. Mg. Shwe E, D. R., III grade, Thaungyin Division.
6. Mg. San Nyun, D. R., III grade, North Toungoo Division.
7. Mg. Kan Twe, Hd. Forester, I grade, Bhamo Division.
8. Mg. Myat Shwe, D. R., III grade, Salween Division.

9. Mg. Ba Thwin, D. R., II grade, Upper Chindwin Division.
10 Mg. Po Htin, D. R., III grade, South Toungoo Division.
11. Mg. Lu Gale, Hd. Forester, I grade, Pyinmana Division.
12. Mg. Po Myin, D. R., III grade, Tharrawaddy Division.
13. Mg. E Loo, D. R., III grade, North Toungoo Division.
14. Mg. Hla Maung, D. R., III grade, Pyinmana Division.
15. Mg. Po Hmyin, Hd. Forester, I grade, South Tennasserim Division.
16. Mg. Shein Ba, Hd. Forester, I grade, Myittha Division.
17. Mg. Hok Han, D. R., III grade, Zigôn Division.
18. Mg. Ba Si, D. R., II grade, Maymyo Division.

Mr. Leete then made the following speech :—

MR. CHAIRMAN, LADIES, GENTLEMEN AND STUDENTS,—It has fallen to my lot to have the pleasure once more of being present at the Annual Prize Day of the School and presenting Certificates to successful students. I now wish to address a few words to the students themselves. But before doing so, as President of the Board of Control of the School and also as the Senior Forest Officer in the Province, I desire, for myself and for the whole Department, to express my thanks to the distinguished gentlemen on the platform for their presence here to-day. Forest Officers throughout the Province will, I am sure, be pleased to hear that both the Hon'ble Ministers of Government are with us to-day. It is a happy augury for the future. The presence of the Minister for Education may be taken as significant of the importance attached by Government to the country's forests and to the necessity for seeing that the men who look after them are given the best possible training for their task. My contact with the Hon'ble Minister for Forests has naturally been a much closer one, and it is, indeed, a pleasure to find how keen Mr. Maung Gyi is to become thoroughly conversant with the details of one of the Departments over which he has control. Mr. Philipp and I have already had the pleasure of taking Mr. Mg. Gyi for a short trip off the beaten track in Tharrawaddy, in order to see our river training works there. In spite of his heavy office work Mr. Mg. Gyi has come here to-day

and I have no doubt that in course of time we will have opportunities of showing him at first hand many of the problems which interest us in various parts of the Province. But there is a humorous side to the situation which should not be forgotten. Mr. Maung Gyi does not yet know all he has let himself in for in taking charge of a department like ours. We are a live show; the only justification for our existence is that we are as vigorously alive as the trees we try to grow. But growth has its drawbacks, at any rate to the man who budgets for funds. The suit of clothes which fits us one year is decidedly tight a twelve month later. If I may say so, Mr. Maung Gyi has given himself into our hands by coming here to-day, because he cannot be in this crowded room without feeling bound to back the request made by the Director for funds with which to enlarge it, and make it more suitable for the growing requirements of the School.

Attendance at this function has to me a personal side owing to my long association with the School. Some 15 years ago I was Director of the School at Tharrawaddy in addition to my duties as Divisional Forest Officer. My own transfer to Pyinmana in 1909 took place a few months before that of the School itself, and, although I ceased to be Director with the appointment of a whole-time officer for the post, I could not remain in Pyinmana, as I did for three years, without taking an active and kindly interest in the School.

Three years ago as Chief Conservator I presented Certificates to successful students, and it is a very pleasant task to perform the same duty to-day. I regret, however, to have to remark that this is the last opportunity I am likely to have of doing so, because the shadow of my approaching retirement is already becoming apparent, and this time next year my place will have been taken by another officer of Government.

Three years ago, when standing here, I made the remark that it was a happy inspiration which lead to the selection of Mr. Philipp as Director of the School. Time has gone by and has brought with it promotion to Mr. Philipp and another Director to the School. But after seeing the way in which Mr. Fields-Clarke has managed the School, and after reading his report, I

think it is only well deserved praise for me to say that in his case, too, it was a happy inspiration which lead to his appointment.

Students, in choosing the Forest Department as a career some responsibility rests on you. The Director in his speech referred to the high traditions of the School which you have worthily maintained. I now wish to give a wider application to the phrase and to remind you that as you now go out into the world, or rather out into the active life of the Department, it is for you to do your share towards maintaining the traditions and high standard of efficiency which the whole Department has attained in the past, and this is a task which is shared alike by every officer in the Department, no matter what his rank may be. Even though there may be critics who think and say that the Department is more or less exotic, that is, has not justified its existence, that the country would be better without it, that the staff never lost an opportunity of oppressing the people and that expenditure is heavy and unjustifiable, nevertheless, with an inside knowledge of the working of the Department for nearly 20 years in Burma, to say nothing of previous 12 years in India, I do maintain that, with the material available, the efficiency of the Department is high and that its value to the Province is unquestionable.

And that brings me to my second point. I have just said that the efficiency of the Department depends on the type of men in it. It is a well-known fact that we have had great difficulty in attracting a sufficient number of a good class of Burmans for service in the Department. The attractions of other branches of Government and of private employ have proved stronger. Now you students can, if you will, in after-life help to improve matters. Those of you who do well can confidently look forward to promotion on a liberal scale, and all of you can wield an influence which may have beneficial effects or otherwise of a very far-reaching character. It rests with you to convince the people by your own conduct not only that the stories about oppression are exaggerated, but also that the future welfare of the Province is bound up with the existence of the Department. For example, you know how long it takes trees to grow. The average villager

does not. You know that people cannot help themselves to an unlimited extent to house posts and poles without seriously endangering the existence of forests. Even if the average villager cannot be expected to take much interest in the timber supply of the next generation you ought to do so, and you ought to let everybody see that you are just as much interested in this side of your duties as you are in seeing that the rules regarding licenses and the collection of revenue are observed.

But there is a lighter side to the future for you. All work and no play is good for nobody. I am very pleased, indeed, to find what a keen interest in athletics is fostered by the Director and staff and how keenly you students have responded. But, I am thinking not only of games such as football and tennis, but also of items in your work which may be of such absorbing interest that the performance of them becomes a pleasure rather than a duty. And here you have an advantage over men in other departments because forest life has a variety of attractions which are not to be met with in the case of men whose duties keep them perpetually in an office or in a town. If your training at Pyinmana has done nothing else for you it has I hope given you some insight into a number of subjects which can be of absorbing interest. Let me mention one or two examples. Photography is now within the reach of many, and it is one of the pleasantest ways in which a man can compile a record of his daily life in the forests. It is, indeed, a great regret to me that I have no such record for the first five years of my own service, because I did not take up photography until after that. Again, three years ago I advised students to make a hobby of something or other, whether directly connected with their work or not. I say the same thing to you, as most of you know I am never so happy as when busy in a carpenter's workshop or in a sawmill, and, although my hands often suffer and my back sometimes feels broken, yet the time spent on such recreation has been extremely pleasant to me and has not been without its profit to Government. I know of no better way of learning the comparative qualities of various woods than by using a plane or a chisel on them. But tastes differ, and I do not expect you all to follow the same line as myself. It is,

indeed, fortunate that our tastes do differ, because there are so many different branches of study in forests, that it would be a pity if any of them were to be entirely neglected.

In conclusion, students, let me go back once more to that word tradition, to the traditions of the Forest Service in all its branches; a service which has been built up by a succession of men who have given the best years of their life to Burma. The organisation that has been built up within the past half-century is one of which we are justifiably proud, and we have an intense desire to see that this tradition is maintained in future. It is true that the burden has hitherto rested mainly on the shoulders of men recruited from Europe. It is also true that this is not because Burmans have been refused admission to the higher ranks of the service, but that they have not been forthcoming to take up such service, and it was only natural that this should be so. Education in Forestry is only of comparatively recent growth in Burma. As the Director has already told you it is only 22 years since the first Forest School was opened at Tharrawaddy, and only ten years since its transfer to Pyinmana, and the starting of the course in English. Lastly, as most of you are probably aware, another course of training in connection with the University at Rangoon is being started to replace training at Dehra Dun. All these steps in forest education have been taken with a view to fitting Burmans for the management of the forests in their own country. But my point is this. It remains to be seen what sort of response there will be. With the change in nationality, there need be no change in the spirit of the Department. It rests with you who are now about to leave the School, and with men who will pass through Pyinmana and Rangoon in after years, to see that the standard in the past is not only maintained but steadily improved. It will not be an easy task, it will call for the putting forth of the best that is in you, it will call for self-control and the exercise of sympathy in your relations with your own fellow countrymen and others.

And now, Ladies and Gentlemen, I will ask the Honb'le Minister for Forests to distribute medals and prizes to the students who have been selected by the Board of Control for these distinctions.

Mr. Leete's speech was then translated into Burmese by U. Kyaw, A.T.M., Instructor at the School.

The medals and prizes were then distributed by the Hon'ble Minister for Forests, Mr. J. A. Maung Gyi.

GOVERNMENT SILVER MEDALS.

English Class.

1. The best 2nd year student in Forestry—

Mg. Kyaw Zan.

2. The best 2nd year student in Forest Engineering and Surveying—

Nai Thean Kee.

Vernacular Class.

1. The best 2nd year student in Forestry—

Mg. Ba. Than.

2. The best 2nd year student in Forest Engineering and Surveying—

Mg. Tun Mya.

The *U Po Hnit Gold Medal* for the best student in the English Class—

Mg. Kyaw Zan

The "*Old Students*" *Gold Medal* for the student in the Vernacular Class most likely to make a good forest officer—

Mg. Shwe E.

The "*Indian Forester*" Prize for the best practical forester in both classes—

Nai Thean Kee }
Kan Twe } Divided.

The "*J. E. Du Bern*" *Gold Medal* for the best athlete—

Maung Sein.

The following speech was then delivered in English by the Hon'ble Minister for Forests :—

MR. LEETE, LADIES AND GENTLEMEN,—

It is a great honour to me to be invited here to-day to perform one of the leading acts at this function, that is, the

distribution of prizes and medals. For the first time in the history of this Province the portfolio for Forests has been given to a son of the soil. Every true Burman must be thankful for having accorded him what has not been given to any of the provinces of India, the portfolio for forests. It is the first time also that I have attended any great function of this kind in which I have to act as one of the principal actors in giving away prizes and medals because one is expected to say a few words after the distribution. I have always realised that my store of knowledge and experience is so limited that it does not entitle me to sit in judgment of what others should or should not do; and I have successfully avoided all enticements to attend a function of this sort, but the honour that I told you, I felt, is one that is conferred upon me, pressed upon me in fact. I will tell you why. One fine day in February Mr. Leete, the Chief Conservator of Forests, came to me and sprang a surprise upon me. He said "There is the Pyinmana Forest School in which there will be distribution of prizes and medals. We want you to come." So, as I told you, I have never attended a function of this kind, and I tried to avoid it. I asked him if it would be really necessary that I should be present. Of course, the Chief Conservator, Mr. Leete, is a diplomat. He said that it would please the Forest Department if I would do so. There was no other answer to that except to accept the honour that was thrust upon me. Now that I have come, I may say that to that honour has been added great pleasure.

As far as the professional side of the Department is concerned, Mr. Leete has addressed the students in detail, and, as far as the working of the School is concerned, Mr. Fields-Clarke has already read the report, so that there is very little for me to add. I should like to say that Government is taking great interest in encouraging Burmans to join the Forest Department which is sadly neglected by them. It is especially so in the higher grades of the service. The existence of this School shows that Government has, from the very beginning, tried to encourage Burmans to enter the Department. Now we have created a Forestry Course attached to the University of Rangoon in which Govern-

ment expects Burmans, the sons of the soil, to enter as students in order that they may, after qualifying, become members of the Burma Forest Service. Further, we have also offered a probationership in the Imperial Forest Service to Burmans who are fit to be selected, and the selection will take place some time this month. So you see that Government is doing its best to encourage Burmans to enter the Department, and, as long as I am in charge of this Department, I will do my best also to further the interests of every member of the Service, and they can rely upon me that their interests will be well looked after.

Now to the students I would like to say a few words of advice—not that I am entitled to advise them, but still, as is expected of me, I will say what I think will be best suited to them in their career.

There are three things I should like to remind them. The first thing is honesty. As soon as you enter upon your charges, you will lay yourself open to great temptations and you must resist those temptations. However able and educated you may be, without honesty ability and learning are useless.

In the second place, I would enjoin upon you to observe the strict rules of discipline. You have been trained here in discipline, and I hope that in your career and service you will always bear in mind that discipline is most essential. We Burmans are most lacking in discipline; we dislike discipline altogether, and that is the feeling that we ought to overcome.

In the third place, I would ask you to think that when you proceed to carry out your orders, you should think why your superior officers gave you those orders and find out the motives or the objects for which they were given ; because the man who thinks is really the true man ; the man who does not think is little better than an animal. It is only a man who thinks who is able to do things ; and you have plenty of leisure while carrying out your duties towards yourself as well as towards others.

Now forest life is not very popular with Burmans, that is because they do not understand what forest life means. I have been in the forests myself, I have seen trees girdled, felled, ex-

tracted, and taken to extraction points; I have seen them sawn up in mills, because for some time in Siam I had to advise the great Corporation, the Bombay Burma Trading Corporation, Ltd., which is also one of the big Corporations here. I have also seen Forest Officers in Siamese service while I was in Siam, and I can assure you that forest life is one of the most attractive lives that can be found. Further, the forest man, for the greater part of the year, is cut off from all men of his kind or people of his calibre or mental attainments, and that he spends his life all by himself in solitude carrying out his duties. Now man is a gregarious animal, and he will naturally desire the society of his friends; and a man who can lead a lonely life and feel happy is more than a man; he is one of the finer and higher type of men because a man who cannot live alone must seek the society of others. He must attend *pwes,* dances, and performances to distract his mind, to keep his mind occupied. But the true forest man is a man, as I tell you, who belongs to one of the higher and nobler types of man because he is self-contained and does not need the society of others to cheer him in his loneliness. Whatever you may do, I would ask you to bear this in mind that if you can carry out your duties in the forest as a good forest officer and a good forest man, you will be doing a great service to your country and you will be considered as one of the higher types among our people.

The Hon'ble Minister for Education also addressed the students in Burmese. At the conclusion of these proceedings the company then dispersed to inspect the School buildings, the museum, the collections of economic forest products made by the students, and drawings done by them during their course at the School.

Light refreshments were at the same time dispensed by Mrs. Lindsay-Smith. After which the Director gave a breakfast to numerous guests in one of the new lecture-rooms. A *pagal* gymkhana was held in the afternoon on the School recreation ground, which caused much amusement and pleasure.

In the evening an *anyein-pwe* was given by a troupe from Rangoon, which was largely attended.

EDITORIAL NOTES.

We are asked to state that a fund is being raised in memory of the late Provincial student, B. B. Sircar, who was recently drowned at Thadiar. The fund is known as the Bibhuti Sircar Medical Relief Fund. The capital of the fund is being invested and the interest will be used to assist poor indigent patients at the Thadiar Forest Dispensary to buy food.

Any subscriptions will be gratefully received and acknowledged by the Divisional Forest Officer, Chakrata.

BURMA NOTES.

Reforms are now an accomplished fact, and the administration of Forests is in the hands of a Burmese Minister. Fortunately for the Department the gentleman chosen is singularly enlightened in regard to Forest matters in particular. Forest Officers cannot but be grateful for the speech of the Hon'ble Minister in the Legislative Council debate on the Forest Budget. His outspoken championship of Forest Officers and appreciation of services rendered under solitary and often harassing and unhealthy conditions will certainly encourage everybody. The Budget was passed intact by a very narrow majority, the opposition being, perhaps, more in the nature of general policy than any special dissatisfaction with the Department since no item was particularly selected for a "cut."

Arrangements for the institution of a course in Forestry the Rangoon University are now practically complete, and by the time these notes appear in print the lecture term will probably be in full swing. Twelve stipends have been offered by the Local Government, and 72 applications, mostly from well-qualified candidates, were received and 12 men have been selected. The breaking away from Dehra Dun is not because of any shortcoming in either the course or the recruits obtained, but because Burmese parents have a rooted objection to sending their sons to India for two years, with the result that of late years it has never been possible to find candidates for more than a small fraction of the

vacancies offered. The new course will be modelled very closely on the Imperial Forest College, and acknowledgment is due to the officers there, for assistance and advice rendered to the Burma officer who was deputed to study matters on the spot at Dehra Dun.

We understand that ten more recruits for the I.F.S. will arrive next cold weather. This will make twenty-eight since 1921 and will do much to relieve the shortage of staff as soon as the new men pick up the language, and settle down to work. We wish that we could report a proportionate increase in housing accommodation, which is still almost everywhere woefully inadequate.

While Forest education is in the ascendant Forest Research, owing to lack of staff, is in a bad way. It has been found necessary to leave the post of Divisional Entomologist unfilled, as there is such a shortage of Divisional Officers; while the Silviculturist although still nominally in charge of the post, has also had to take over one of the Territorial Circles. Progress under such conditions is impossible.

The Utilisation Circle is busy collecting and despatching material for the Forest Exhibit at the Empire Exhibition next year, and the honour of being chosen as Exhibition Commissioner for Burma in England fell to Mr. A. Rodger, O.B.E., Conservator of Forests. With him in charge of the whole of the Provincial exhibits there need be no fear that our interests will not be well looked after.

OBITUARY.

COLONEL GEORGE FALCONER PEARSON.

We much regret to have to record the death of Colonel G. F. Pearson at his residence at Kington, Herefordshire, on the 25th April, 1923, in his 97th year.

Colonel Pearson was the eldest son of the Rev. George Pearson, Rector of Castle Camps, Cambridgeshire, and was born at Chester on the 12th November, 1826. One of the earliest events he used to mention as remembering was the coronation festivities of William IV. at Cambridge, where the firework displays remained vividly in his mind. He went to Mr. Jones' School at Cambridge at the age of 9 and remained there until he was 13½, when he went to the Charter-house in London under Dr. Saunders. One of his associates at Jones' School was Bishop Barry, afterwards Primate of Australia. He spent many happy years at the Charter-house being in Verites, and eventually became head monitor and played for the cricket eleven. Even in those early days he had a strong sense of discipline and had already acquired the faculty of leading others. A story is recorded of him as head monitor, when the youngsters of Saunderites got out of hand and up against their monitors and came over to Verites to spread sedition. The leader was the nephew of the Headmaster, but this in no way deterred Pearson, who, thinking it necessary to make an example, went over to Saunderites, called out the offender, who, arriving with considerable swagger, got the best thrashing of his life. This stopped the trouble, and Pearson got much credit from the authorities for nipping the trouble in the bud.

Through the good offices of his uncle, Colonel Charles Pearson, he was given a commission in the Madras Staff

Corps by Sir James Wier Hogg, Deputy Chairman of the Honourable East India Company, and sailed for India in January 1846, in the 19th year, on the 'Hashemy,' an 800 ton, three masted ship. He arrived in Madras on the 24th May 1846, after a journey of 146 days, and with a batch of other cadets proceeded to Secunderabad, where he was attached to the 36th Native Infantry and joined the 33rd Madras Native Infantry at Jalna on the 12th November 1846, his 20th birthday. In 1848 he was appointed A.-D.-C. to Sir Herbert Maddock, the Deputy Governor of Bengal. It is interesting to note that he did the journey on foot, *viâ* Nagpur to Mirzapore, and from thence by boat to Calcutta. Later when he rejoined his regiment he did the return journey in a 200-ton sailing ship from Calcutta to Bombay, during the monsoon, and was 93 days at sea. In September 1849 he became adjutant of his regiment and held this appointment for four years. In September 1849 his regiment was moved to Mhow, and the next four years were very happy ones in his life. He was a great sportsman, and often told stories of his shooting trips along the Nerbudda Valley and in Bharwani during this period. His companions on these shooting trips were often Mayne, of the Viceroy's Body Guard, and Dunn of his regiment, and between them they accounted for many tigers. He accompanied his regiment when it was moved to Nagode at the end of 1853, marching through Bhopal, Bilsa, Saugor and and Damoh, and soon after took 6 months' leave, when he went to Tibet. He crossed the Himalayas by a pass lying between the Niti and Milan passes in British Gharwal. On this trip he shot many burral, thar, and several bears. At the end of 1854 Colonel S. A. E. Ludlow, R.E., the Chief Engineer of the N.-W. P., obtained Colonel Pearson's services, appointing him Executive Engineer, and in this capacity he constructed the road from Nagode *viâ* Kalin-

ghur to Banda, a difficult piece of work for which he received the thanks of the Supreme Government. The road, which runs west of the Mirzapore-Jubbulpore road, proved of great service in the Mutiny, as it was the only one suitable for Artillery to cross the high ghât range separating the plateau of Bundelkhand from the Ganges valley. Early in 1856 Pearson was again on road work in Mundla, and soon after proceeded Home on his first leave after ten years' service.

He arrived Home on the 3rd July 1856, and spent much of the following winter hunting round Cheltenham. In 1857 on receiving news of the Mutiny he at once returned to India, arriving on the 20th August, at which time his regiment was at Jubbulpore. He had a difficult journey up-country from Madras, as at that time it was thought that the Hyderabad Contingent had mutinied, while one regiment at Saugor, and two at Jubbulpore had already done so. Eventually in September he arrived at Jubbulpore with the "A" Troup of Horse Artillery under Molesworth, when the Saugor Field Force was organised, consisting of the Oxfordshire Light Infantry, the 6th Cavalry, his own regiment, and two or three batteries of Artillery. Colonel Pearson was then sent with two companies of his own regiment and a couple of guns to guard the Sankalghât on the Nerbudda in the Narsinghpur District, and had about 3,000 rebels of the regiments which had mutinied in Saugor and Jubbulpore to contend with. Luckily they never attacked in force, but contented themselves with sniping. After Christmas, 1858, the whole Saugor Field Force was collected, crossed the river, and carried out a sweeping movement, which resulted in some sharp fighting, especially at Patan, where a heavy attack was carried out up a steep hill, resulting in considerable losses to the 33rd M. N. I. Colonel Pearson records that our losses would

have been very heavy had not the shooting of the enemy been wild. Later, two divisions were formed, one under Sir Hugh Rose and the other commanded by General Witlock, the 33rd N. I. being attached to the latter. Pearson, however, never marched north with Witlock's division as he was attached, due to his knowledge of the locality, to a battery of artillery and sent to Raipur, where the 3rd Nagpur Infantry had mutinied. On arrival at Raipur it was found that the regiment had bolted, and he had to camp on the maidan in May, in a single belt tent, in the greatest of heat, as the mutineers had burnt all the houses before their departure.

It was about this time that corps of Military Police were being raised in Central India, and he applied at once to Erskine to be allowed to raise such a force. By return of post he was appointed Commandant of the Seoni Military Police Force, but this body of men existed on paper only and Colonel Pearson had to raise the force. He was given Rs. 10,000 to do so, a quite insufficient sum, and, as there was no likelihood of obtaining further supplies for some time he borrowed Rs. 30,000 at his own responsibility from a Bunnia in Kamptee in order to get his force into the field without delay. He took a drill sergeant from his own regiment and half-a-dozen good N.-C.-O.'s. McIntire gave him a Risaldar-Major and five native officers from the 2nd Hyderabad Cavalry and within 3 months he had 450 infantry and 150 cavalry in the field. The Commander-in-Chief also sent him as Second Risaldar General Nicholson's orderly, who was with him when he was mortally wounded at Delhi, as the General was a friend of Colonel Pearson's. Great credit was given to him for the speed with which he had got his force into the field, which could never have been done had he not taken the responsibility of borrowing money on the chance of it

being eventually sanctioned. It was in August 1858 that Colonel Pearson had a very unpleasant experience. Tantia Topi, when making his last raid on Nagpur, halted 16 miles from Seoni for 3 days, undecided whether to attack, having 3,000 cavalry with him, whereas Colonel Pearson had only 200 raw Military Police and 15 to 20 sowars. The position was critical. Erskine put Pearson in charge of the district, superseding the Deputy Commissioner, who not only resented this act, but also the fact that Colonel Pearson had pulled down his Kutcheri to put the place into a better state of defence. The position of affairs changed, however, to Colonel Pearson's great relief, by Tantia Topi's going off in another direction and being captured a fortnight later. It was during this time of the Mutiny that Colonel Pearson met Lord Roberts, then a junior officer, Sir Alexander Taylor, General Dick Lawrence, Sir John Coke, and Colonel Shakespear, whose acquaintances developed later into lifelong friendship.

For three years it was Colonel Pearson's duty to patrol the Nerbudda Territories and make drives for what were known as rebels, but who were what are now termed dacoits. This work naturally lead him into the jungles, and where numbers of so-called contractors were felling teak right and left with the hope of supplying sleepers for the Jubbulpore railway, the scheme for which was under consideration. It was Colonel Pearson's duty to submit periodical reports on the state of the country, and in these reports he repeatedly mentioned the wanton destruction of the valuable teak forests. This may be said to be his first connection with Forestry, as on 15th August 1860 he received a telegram from Sir Robert Montgomery, the then Lieutenant-Governor of the N.-W. P., offering him the Conservatorship of the Saugor and Nerbudda Territories, which he accepted. Later, he was offered an appoint-

ment in the C. P. Commission, but his interest in forestry did not allow him to accept this appointment. His first duties as a forester were to clear out the dead and felled teak lying about in the forests and then to carry out long tours of inspection to ascertain the nature and condition of the forests with a view to forming reserves. The work soon became too heavy for one man, and he appointed Capt. Forsyth of the 26th Bengal N. I. and Capt. Douglas of his own regiment as his assistants. In 1862 the Central Provinces were formed and placed in charge of a Chief Commissioner, while in 1865 the assigned districts of the Berars were added to his charge. In 1863 Sir Dietrich Brandis, the first Inspector-General of Forests, paid a visit to the C. P. and toured with Colonel Pearson through Mandla and Bhandara and they completed their tour at Jubbulpore. It was during this tour that they discussed the first principles of the Forest Act, and in the following year Colonel Pearson was called to Simla, when the whole idea was elaborated and first committed to paper. About the same time the number of his assistants in the C. P. was increased, and amongst others Capt. (later Colonel) Doveton, of the 1st Madras N. I., and Mr. Jacob, a policemen, were recruited, the former officer eventually becoming Conservator of the C. P. in the place of Colonel Pearson. If was in the hot weather of 1863, after his tour with Dietrich Brandis, that Colonel Pearson started fire protection in the Bori Reserve of the Hoshangabad Division, and this he did rather against his own judgment but at the request of the Inspector-General. It is of interest to record this fact, as this is the first instance of fire protection being started on an extended and systematic scale in India. Just after leaving Sir Dietrich Brandis, and before going to Bori to start fire protection, he went, accompanied by Capt. Forsyth, to

Pachmarhi to arrange the first agreement with the Thakor to lease the place, with a view of establishing a hill station for the C. P. and it may be mentioned that they shot at least 8 tigers on their way up the hill. He left Forsyth in Pachmarhi to build the first bungalow, and went off to Bori. In order to ascertain the suitability of Pachmarhi as a hill station they maintained comparable temperature registers at both places, which showed a maximum temperature in Bori of 117° F. and 92° F. in Pachmarhi, though the minimum temperature were practically the same. During the years 1860—63 Forsyth, Douglas, and Doveton were chiefly employed on selecting reserves and carrying out demarcation work. The rains of 1863 saw Colonel Pearson in Simla engaged on the Forest Act and other matters, and during the cold weather of 1863-64 he inspected S. Berars, Betul, the Melghat, and Hoshangabad. He had two mishaps during this season, one on his way down to Bombay for Christmas, where, while walking down the line at night which was under construction, he fell through a half-finished bridge, broke his collarbone and lay there till found in the morning, and later in the season he got a sunstroke which knocked him up fairly severely for a time. He went Home in the hot weather of 1864 and married the daughter of the Hon. J. Erskine, but lost his wife in 1865, leaving him a daughter, who has been his constant help and companion until the day of his death. The end of 1865 found Colonel Pearson again at work in the forests of the C. P. He met Sir Richard Temple soon after his return, and they discussed the future policy of forests, which resulted in considerable survey work being undertaken and the staff being materially increased. The next three years were busy ones, and little time could be found for shooting, the forests were thoroughly inspected, and amongst other matters Brereton was sent to make a survey of the Ahere District, which took

a year and-a-half, and on this map the general grouping of the neighbouring provinces was eventually based. In addition to the heavy work connected with forests, Sir Richard Temple gave Colonel Pearson charge of repairing tank bunds over large areas, and especially in the South Bhandara District, and also to inspect the country with a view of fixing the general alignment of the proposed Nagpur-Calcutta Railway, and where it should cross the Machna and Wainganga rivers. In later years he often used to say that he was not a little proud, that the places for crossing the rivers, and the line itself, chosen by him, were those eventually adopted. The line was not made until 20 years after, but it was on Sir Richard Temple's report, based on Colonel Pearson's recommendations, that the engineers started their surveys. In 1868 he took three months' privilege leave to see his daughter, going from Suez *vià* Ismalia to Alexandra by rail, and in the S.S. "Poona," a 2,000-ton boat, to Marseilles, returning in the same ship, arriving back in India in October 1868, when he was posted to the Conservatorship of the N.-W. P. His charge consisted of the Dun, all the Ganges Divisions, Bijnoor, under the Commissioner of Meerut, the eastern district under the Commissioner of Patna and Kumaon, under the then Commissioner, Sir Harry Ramsey. During 1868-69 he toured all through these forests to see what this charge consisted of, and, as partial control had already been enforced, his work was largely of an adiministrative nature. Amongst other places he went to visit Bundelkhand and to see his old friends ; in March 1869 he was in Gorakhpur returning along the foot-hills, and then marching north through Kumaon. Later, he visited Jaunsar and the Tons valley where large sleeper sawing works were in progress under the control of Capt. Grieg. This work greatly interested Colonel Pearson, as Capt. Grieg had constructed water slides and sledge

roads, while a wire way was also contemplated. The construction was at a later date started by Colonel Pearson, who eventually got a sapper named Dewalski, to erect it after he had carried out further experiments in Chamba. Colonel Pearson eventually returned to Naini Tal late in July, marching from Jaunsar *viâ* Mussoorie and Tehri. During 1869-70 he visited Kumaon, Gharwal, went up to the Pindari glacier, and across to Wan at the foot of Tirsul, and then from the Ganges valley across a 19,000 ft. pass into the Tons valley, to visit Grieg and two sappers named O'Callaghan and Gracey, who were making a road under his directions, and which they successfully completed, including a suspension bridge across the Nilang River. He returned to Naini Tal in July 1870, when he married the daughter of John Colvin, late Lieut.-Governor of the N.-W.P. and sister of Sir Aukland Colvin, who later was also Lieut.-Governor of that Province. At the end of 1870 Sir Dietrich Brandis, the Inspector-General, went on leave and Colonel Pearson was appointed to act for him, which post he held for two years, until he himself took furlough at the end of 1872. He had no sooner arrived in England than he was deputed to report on the recruits sent for training to France and Germany, which resulted in the future training being carried out at the National Forest School at Nancy. Shortly afterwards he was offered the post of supervising the studies of the future Indian Forest Officers at Nancy, and he had to decide between accepting the post or returning to India to take up the permanent duties of Inspector-General. He selected the former post, chiefly because he felt that it would be to the advantage of the service to have as head a trained forest officer, when the number of trained officers was year by year increasing, and partly for family reasons. He remained at Nancy until May 1884, during which time over 60 forest students passed through his

hands, many of whom were destined to have brilliant careers in India. His years at Nancy were extremely happy, except that he lost his second wife in 1876, when his youngest son was born. The relationship between the French and English Students was most cordial, while he formed lifelong friendships with many of the French staff, who often visited him in his home in England, long after his retirement.

In 1876 Colonel Pearson retired from the Army on the pay of his rank, but continued as before in charge of the students at Nancy. In 1878, in addition to his other duties, he was appointed as a Commissioner at the Paris Exhibition, when the whole of the raw produce of the British Colonies passed through his hands, as also the India Forest Collections. He retired from Nancy in 1884, and it is interesting to note that he lived to see all the forest officers who passed through Nancy during the 12 years he was there, complete their services and retire from India, the last of whom, we think we are correct in stating, was T. R. D. Bell, C.I.E., late Chief Conservator of Forests, Bombay. His work at Nancy did not, however, sever his connection with the Indian Forest Department, as, on the reorganisation of the Board of Visitors at Cooper's Hill, he was made Visitor of the College on behalf of the Forest Branch at that Institute. This post he held until 1902, so that from first to last his official connection with the Forest Department extended over more than 42 years.

In 1884 Sir John Lubbock, later Lord Avebury an old friend of Colonel Pearson's, suggested to him taking up a working partnership in Messrs. Davis & Co.'s Bank (the Kington and Radnorshire Bank) in Herefordshire, which he decided to do, and he carried on banking with

success, greatly extending the business, until about 1911, when he and his partner sold the business to what is now the London Joint City and Midland Bank.

When he first started business he lived at Downton Hall in Radnorshire, riding in daily to his work some 6 miles each way, in all weathers, later, about 1895, he bought a house near Kington, close to his work, where he lived until the day of his death.

Colonel Pearson made many friends wherever he went; he was a man of shrewd judgment and full of tact, but, above all, he had a most wonderful memory till the last. His physical strength was far above the average, and in his time in India few could match his walking powers. Sir Dietrich Brandis was his master in walking in the hills, which Col. Pearson fully admitted, but he could outwalk him in the plains. He was a fine, fearless rider and good judge of a horse. We have before us letters from various officials in India written to Col. Pearson at the time of his retirement, which corroborate the remarks made above, as to his character. The following are a few extracts from such letters:—

Lord Northbrook, the then Viceroy and Governor-General of India, wrote: "During the time when you held the important office of Inspector-General of Forests I know that you performed your duties with industry, energy, good sense, and tact in dealing alike with your official superiors and subordinates, and your retirement will be a loss to the Department."—Sir Richard Temple wrote in the same strain, stating "that if integrity, activity, diligence, devotion to duty, good temper, and experience go to make a good officer, then you may claim to have the material for one in you."—Sir Dietrich Brandis,

writing at the same time, says: "During his whole official career Colonel Pearson distinguished himself by excellent tact and temper, good judgment, great industry, and administrative ability."

Colonel Pearson was J. P. for both Herefordshire and Radnorshire, and was always interested in public work to the last. He had the Indian Mutiny Medal, two French orders, and received the thanks of the Supreme Government on two occasions. He leaves one daughter and two sons, the eldest being a Captain in the Navy, and the younger, Mr. R. S. Pearson, who for the last 15 years has been Forest Economist at the Forest Research Institute, Dehra Dun. He lost his third son in 1906.

REVIEWS AND EXTRACTS.

TWO REPORTS ON FORESTRY IN KENYA COLONY AND IN UGANDA,

BY R. S. TROUP, C.I.E., I.F.S.

These reports are the outcome of a four months' visit to the Colonies of Central Africa by Prof. Troup in the autumn of 1921.

Severely practical in form they are written for officials and non-officials who are already well acquainted with the general physical characteristics and varied populations of this part of the globe. They would have been more enlightening to forest officers elsewhere if a few lines had been devoted to a short general description of the countries and their peoples, and to a brief history of the forest administration.

Both reports are written in practically the same form and are illustrated with useful maps.

I.—*The Kenya Report.*—From a perusal of it and of the map attached therewith it may be gathered that "more than three-fourths of the area of the colony consists of arid and sparsely-populated tracts covered largely with thornbush, where the amount of timber and firewood consumed is negligible." And so it is that, although there are 5,000 sq. miles of State forests and 100 sq. miles of private forests they merely cover 2·08 per cent. of the area of the colony. Only 3,207 sq. miles of the State forests are administered at present.

Mombasa is the headquarters of a Coast Forest Division of 316 sq. miles—half of it mangrove creeks, the produce from which is carried in the form of poles by Arab traders to the Persian Gulf and South Arabia. Leaving the coastal belt the Uganda Railway climbs gradually through a stretch of nearly 300 miles of dry and savannah country, much of it infested with the tsetse-fly, to Nairobi (elevation about 5,000′) and thence in another stretch of 200 miles crosses the Highlands and the Rift valley and drops again to below 3,000′ at the Lake Victoria Nyanza. The remaining five Forest Divisions are all situated in the Highland and comprise nearly 2,900 sq. miles of administered forest in

blocks of large or considerable size, the biggest being those on the lower slopes of the two great volcanoes, Kenya and Elgon, and on the Aberdare Mountains.

Prof. Troup deals in an interesting manner with the different forest types of these uplands. They are essentially evergreen owing to a well-distributed but not necessarily heavy rainfall. In the mixed *Plateau forests*, typically represented near Nairobi, and situated on red laterite soil between 5,000′ and 6,500′, with a rainfall of about 40″ *Brachylaena Hutchinsii*, *Croton Elliottanus* and *Olea chrysophylla* appear to be the most typical among a number of strange species. The first and most important is a giant composite up to 100′ high with a long clean but much fluted hole, giving a hard fragrant durable timber resistant to termites and an excellent fuel. The natural regeneration of both it and the Croton is often plentiful.

The *Cedar forests*, in which the E. African pencil cedar *Juniperus procera* is the principal tree, are situated typically between 7—9,000′ with a somewhat higher rainfall than the last. The Juniper is a big tree and is associated with *Podocarpus gracilior* and two *Oleas* and many other species; the shrubs and herbaceous undergrowth are naturally denser than in the plateau type, but the forest is often intersected with grassy glades at the lower drier limits, and here fires have been very destructive. The cedar is also subject to severe damage from a fungus, *Fomes juniperimus*.

The third type is the *Temperate rain forests* which occur on the east slopes of Mt. Kenya, and the Aberdares, between 7—9,000′ and in a zone having a rainfall of at least 55″. The principal species in the lower half is *Octea usambarensis*, the so-called camphor, "an immense tree with a buttressed base and a clean cylindrical bole not uncommonly attaining a height of 120′ and a girth above the buttresses of over 30′. The timber is remarkable for its durability. *Podocarpus milanjianus* is also typical and reproduces itself freely under shade.

The last type to be mentioned is the *Bamboo forest* consisting of the one species *Arundinaria alpina* and occurring chiefly between 7,500′ and 10,000′—at its lower elevation as an under-

growth in tree forest, and above as a more or less continuous belt above the tree limit. This distribution is exactly similar to that of the *Arundinaria* spp. of the E. Himalayas where the pure *maling* forest is simply the result of fierce forest fires. The *A. alpina* appears to be a good deal bigger than the Indian species, being, it is said, from 30′ to 60′ high and 2″ to 4″ in diameter and covering the ground very densely in places.

The writer of the report lays stress on the need for preserving all the forest that has survived the grazing fires of the pastoral tribes, and the destructive clearing for temporary cultivation. No one who has seen the utter bareness of some of the hills of South Africa and realises the extreme difficulty and costliness of reafforesting large denuded areas of hilly country can doubt the absolute necessity for caution if only in the interests of the water-supply. Some of the settlers are already fully alive to the danger of the situation.

Fires which originate inside the reserves are also troublesome, the collection of honey being responsible for a good many as is the case elsewhere. The organisation of fire protection is evidently rather backward.

The proposals for the improvement of the management run on lines which are familiar to Indian forest officers. At the time of the author's visit the standing trees were marked under the rough form of selection fellings, but the royalties were charged on their estimated contents *before* they were felled! For purposes of exploitation the greater part of the accessible timber had been divided among timber concessions, some 30 or 40 in number, and conversion was being done almost entirely at sawmills. Prof. Troup remarks on the defective work in logging conversion and especially stacking after the latter and also on some serious defects in drawing up certain of the leases. There is only one long term lease extant, but this apparently covers 320 sq miles of valuable and accessible forest and runs on until 1958!

The *weak spot* in the management is the almost complete absence of working plans or schemes, and of maps to accompany them. A programme of work to cover 5 years is suggested and

comprises 1,664 sq. miles of topographical survey and working plans. One surveyor on £400 a year is already in the service and it is considered that with another added, the survey programme could be completed in the time. Retrenchment in India will perhaps make more than one officer available who has had experience of forest survey work if required.

It is proposed in the report that the D. F. O.'s draw up working plans for 504 sq. miles, and to employ two special working plan officers for the remainder. The writer considers that accurate topographical maps on a scale of not less than 2″ to the mile are needed. This is no doubt, the ideal, but unless the working is to be intensive, accurate modern maps on the 1″ scale should suffice.

In the discussion of the system of management it is made clear that many of the forests have been heavily worked by the selection of the best trees of valuable species and while excuses are found for this as a temporary measure a more conservative and rational method of treatment is advocated. More concentrated working is recommended but at the same time the forests are described as being irregular and the age-classes frequently mixed together. The method of clear-fellings in periodic block I, followed for the most part by artificial regeneration, and of selection fellings in the last three out of the remaining four periodic blocks of each working section is put forward for the principal method and notes are added regarding its applicability to the different types of forest already described.

No rotation is actually recommended but one of 100 years is mentioned as an example. No indication of the rate of growth of any of the principal species is given in the report, but on the analogy of the S. African *Podocarps* and associated species, 100 years would be too short except as a rotation of conversion.

In a variety of mixed Indian and Burmese forests the proposed method is indeed being introduced *by degrees*, but it cannot be said to be by any means of universal application as yet and particularly so in areas subject to damage by frost. There are many pitfalls and failures, there is a vast amount to be learnt about the growth of species at different stages, and the possible

mixtures and liability to attack by insects and fungi. The replanting of the cleared forest is gardening on a huge scale.

Moreover, a very considerable degree of devotion to duty is needed, in any but good climates, on the part of those officers who are called upon to reduce this form of treatment to practice. The results are likely to be proportionate to the effort exerted.

In one respect the Kenya Colony is fortunate, namely, that a considerable amount of tree-planting has been done already with the aid of temporary cultivation of maize and other crops, especially in the tracts near the railway where natural forest has been cleared for the fuel supply. It is reported that such "work is carried out efficiently and cheaply. The cost of clearing, planting and initial weeding works out at about £1 per acre, this being exclusive of the cost of staff and of raising plants in the nursery." Where the number of cultivators is too few to secure complete regeneration by means of field crops, an experiment is being made of planting in lines 10′ or 12′ apart (the spacing in the lines is not mentioned) cut through the undergrowth, and kept clear, until the plants are free from danger of suppression. According to our Indian experience, such wide spacing is likely to prove a failure with planting, as opposed to sowing thickly in broad lines, for the early closing of the canopy is the first and absolute essential consideration.

It has been stated above, that in certain types of forest natural regeneration is plentiful in parts, and obviously this will be taken account of when their turn for being cut over comes round.

An interesting note is given about the reproduction of the *Octea* forests. The huge overmature "camphor" trees are present, but there is a great deficiency in the lower girth classes and saplings and regeneration, and "artificial regeneration by seed is apparently out of the question since there is only one record of good seed having ever been collected, and that only in small quantity." Nature however seems to have solved her own problem, since even the largest stumps are able to produce a vigorous growth of suckers and stool shoots, capable of pushing through a heavy weed growth, especially where there is plenty of

overhead light, and of making an initial height growth of some 3' a year.

In former years many attempts were made to introduce exotics. Very few appear to have prospered, but some of the Eucalyptus, in particular *E. Globulus*, and other Australian trees are reported to have succeeded well. The importance of bringing in some fast growing species lies in the fact that there is neither coal nor oil in E. Africa, and wood fuel is an essential, for burning on the railway, and for other purposes. The fuel species ought therefore to have a good calorific value as well as rapid growth. The introduction of exotics on the whole is condemned.

It has been shown above that the forests of the Highlands are far from the coast, and the port of Mombasa again, is not exactly on a main ocean route. Whether there is really any surplus of timber for export is doubtful ; if there is, than a large importer, S. Africa, is at hand. It seems however that very considerable quantities of teak from Burma, and coniferous wood from temperate zones, are imported already. The prices of indigenous timber at Nairobi are very high, all scantlings and planks of the better-class timbers ranging from 5 to 10 shillings per c. ft. although the Government royalties are only a small percentage of the working costs.

The report deals in detail with the possibility of creating a bamboo paper pulp industry in the Colony. There are three areas of 40 or 50 sq. miles each, which are now reasonably accessible, and suitable in other ways, but, while the supply of soda from local deposits is ample, that of limestone presents much more difficulty.

The last few pages of the report are devoted to a description of the financial condition and status of the Department, and to such essentials as a Forest Code, as well as to the staff and its improvement. Professor Troup rightly propounds that a quasi-commercial department should charge full royalties for produce supplied to all the Government Departments, by book transfer ; otherwise the true financial position cannot be accurately assessed. The forests of the Colony are not being run at a profit at present, but, without giving details, the author states

that they are sufficiently valuable to produce, when fully brought under systematic management, a very considerable surplus.

The "gazetted" staff under the Conservator is in an anomalous condition, there being very few officers of 5 years' service, and in consequence, the administration has become too much centralised. A larger staff (of 17 officers) is proposed, and is evidently needed, including one research officer. Foresters are recruited and trained in the United Kingdom; they draw about half the pay of Assistant Conservators. Unless there is a misprint in the report, there are remarkably few posts of forest guards; these are natives of the country and are paid Rs. 12 per mensem and upwards.

The perusal of the report leaves the impression that, there is a great deal of solid work to be done in all the branches which comprise forest administration and management, so as to bring the Forest Department of Kenya Colony up to the standard of efficient working which is necessary for it to take its proper place as part of the permanent political and economic machine in E Africa. There can be little doubt that a broad policy is wanted in order to make the Colony, and especially the Highlands permanently self-supporting in forest produce, after making full allowance for the expansion of the population.

II.—The Uganda Report.—This report of the forests of the protectorate is of less general interest to outside foresters than that of the Colony. The forests in both present similar features, but, as those now accessible in Uganda all appear to lie between about 3,000′ and 5,000′; (important tracts on the high mountains in the western district and on Mt. Elgon being outside the zone of the systematic working), they are necessarily of fewer types. The only important type of timber forest is the rain forests, which are confined to the vicinity of the great lakes, and of the mountain masses mentioned above. Of this there are various sub-types, and Prof. Troup describes the principal forests in some detail. From his descriptions it may be surmised that the principal timber trees in the hilly or undulating country are *Entandrophragma utile* *Khaaja anthotheca* and *Carapa grandiflora*, all with mahogany-

like wood, *Cynometra Alexandri*, *Symphomia globulifera* and several others, while along the low shore belt, and on the Islands of Lake Victoria, *Podocarpus gracilior* and *P. milanjianus* are common. In the associated swamp forests *Phœnix reclinata*, *Eugenia cariensis* and the *Raphia* palm are typical.

The other types are the *Savannah* and *Evergreen bush forests*, the first of which are very extensive, and of many different forms, with grasses of luxuriant growth varying from a foot or two in height to the tall dense "elephant grass." Periodical grass fires of great intensity prevent the survival of all but the most fire-resisting species of trees. The most important sub-type of savannah forest from the economic point of view is that in which the prevailing tree is *thamvule* (*Chlorophora excelsa*). The principal *mirile* tracts are situated in Busoga to the north of Lake Victoria, and are estimated to cover an area of about 700 sq. miles......Several fires have done immense damage to the trees which have been killed in great numbers.

Up to the time of Prof. Troup's visit the organisation for the systematic management of the Crown timber forests and their administration had been very backward, the superior staff extremely small and the work much centralised in the Chief Forestry Officer—so much so that, in 1921, all the forests had not been located with even tolerable accuracy, and the demarcation, survey and mapping, and methodical protection had been barely begun; no forests had been placed under working plans, and there were no forest divisions, as these are understood elsewhere. Three of the most accessible forests were being exploited departmentally and three other worked under leases, the terms of which, were defective in certain obvious ways; the defects, as the report states, being due mainly to the necessity for drafting some sort of agreement, the terms of which could be carried out by a numerical weak staff.

In both Kenya and Uganda there is the additional problem of the Native Forests, *i.e.*, those in the native reservations and (in Uganda) in the Baganda Kingdom. In this latter there are 300 sq. miles of forest in blocks of not exceeding ½ sq. mile in extent and entirely free from Government control. The Central Africans

require chiefly pole timber for their houses, and this can easily be produced under the coppice system with such indigenous species as *Dolichandrone platycalyx*, and exotics as certain Eucalyptus and perhaps wattles.

There is also the matter of native rights to produce from the Government forests. In regard to this it is stated that, "the Attorney-General has ruled that the right of natives to cut wood for building purposes under the 1907 Agreement is confined to wood used in the construction of native huts, and not of houses of European style."

Coupled with the general question of supplies of essential produce is that of wood fuel for the railway and steamer services. While there has been no special difficulty in past years, the future supply must be ensured, Uganda being even more awkwardly placed for obtaining coal and oil than Kenya, and so, plantations will have to be formed in convenient centres.

The author of the report proposes and discusses a 5-years' programme of surveys and working plans with a system of management, all of which are on similar lines to his proposals for the adjoining Colony; they have been sufficiently commented on above. The working plan programme is for 677 sq. miles. As the gazetted staff has been increased recently it is proposed that, simultaneously with the creation of four Divisions, the working plans shall, for the most part, be prepared by the Divisional Officers. This would be a comparatively simple matter for an experienced staff, but it is asking a lot of young officers unless the plans are merely simple schemes.

The Uganda forests are badly placed for both the import and export of timber. The only possible future market, outside the Kenya Colony, appears to be down the Nile. There would seem to be no need to think about this, until the organisation is placed upon a much sounder basis.

The agency of exploitation is discussed and decided in favour of departmental working, for one reason because the greater part of the timber removed is for supply to Government Departments.

Exploitation is evidently hampered, at the lower elevations in Kenya, by the presence of the tsetse-fly, which confines the means of extraction to mechanical methods such as tramways, in the Minzira forest on the Lake Victoria, and elsewhere, to man-haulage alone. This constitutes a severe handicap to the work.

Government Departments in the Protectorate receive their supplies of timber and other produce at reduced rates, and this makes the statement of financial results useless for the purpose of determining the true financial position of the Forest Department. Proposals are made to remedy this and to run the latter on strictly business lines.

Enough has been said to show that, although the forests are being cared for, the organisation is very backward. Prof. Troup has pointed out the lines along which improvement should be attempted, and while the whole prospect is less complex than that of the Kenya Colony, there is the same necessity to build a stronger foundation without delay, to eliminate wastage of the present stores of standing timber and other produce, and to make due preparation for future supplies.

R. C. M.

THE FOREST OFFICERS' HANDBOOK OF THE GOLD COAST, ASHANTI AND NORTHERN TERRITORIES.

By T. F. Chipp.

This excellently turned out little volume aims at providing a handy book of reference for Forest Officers and others interested in the welfare of these forests and also, by directing the study of Forest Officers to the main forestry problems of the country, at stimulating the service to produce a more complete and comprehensive compilation at a later date.

The author, after describing the country, its forests and how these are affected by climatic conditions goes on to discuss a forest policy and then gives the history of the Gold Coast Forest Department. After this, come some economic notes (very handily arranged) and a name—index to the flora (divided, after the

manner of a language dictionary, into a Botanical-native and a Native-botanical part). The concluding chapter is a sort of embryo Forest Manual giving the rules in force, and procedure for the sale of forest produce. An appendix on "Outfit and life on the Coast" and a very complete index completes what cannot fail to be a most valuable guide, full of well-produced maps, diagrams and botanical plates.

So much for the book from the point of view of those for whom it is primarily intended but to outsiders like ourselves it is full of interest to a degree that would hardly be expected of a mere manual of information. Perhaps the most striking, not to say sensational, thing in the book is the account, given in a long extract from Mr. Bovill's articles in the Journal of the *African Society*, of what is described, without exaggeration, as "the most amazing case of racial suicide, on a huge scale, that the world has ever seen," but the whole story of the progressive drying up of the country, the gradual encroachment of the desert and disappearance of the forest holds a particular interest for those of us who are accustomed to the reverse process, the gradual spread of evergreen species and the invasion of the dryer by the moister type under fire protection in North-Eastern India.

When we read of the destruction of these forests by shifting cultivation and of the abandoned fields filling up with forest of an inferior type, we cannot help feeling that the "*taungya*" system is the solution and wondering whether this is practicable and whether it has been tried.

It is a little disappointing to find no description of the fauna or game and to read the advice to new comers to bring only a shot gun on their first tour at any rate.

There is no mention of the healthiness, or otherwise, of the country which is somewhat, surprising, as most of the men we have met from these parts have been inclined to resent the popular reputation of the "white man's grave" and this omission rather suggests that the less said about health the better.

This is a book well worth reading whether the reader ever intends to visit the country or not.

E. O. S.

A NOTABLE CONTRIBUTION TO FOREST RESEARCH.

Announcement has just been made of the gift of $200,000 as an endowment for experimental research in forestry, this sum to be equally divided between the Yale School of Forestry and the Department of Forestry at Harvard. The gift is anonymous. The donor, it is stated, is deeply interested in the advance of forestry in the North-East, and especially in New England. The money has been granted in the belief that research and experiment in the field problems of forestry will do more than any other one thing to bring about forestry practice.

The need of forestry is now very generally recognised. The actual practice of forestry is retarded because of the limitations of our knowledge regarding the life and growth of our trees under different conditions and the lack of local experience in applying the methods of forestry. It is to supply the basic knowledge regarding the New England trees and forests and to enable more extensive field experiments in forest production, that the generous gift of $200,000 has been made.

The endowments have been given to Yale and Harvard because these institutions are already carrying on important work of research in connection with forests which they own or control. Yale has forest tracts in Connecticut, New Hampshire, and Vermont. The Harvard forest at Petersham, Massachusetts, constitutes a field experimental station of very great importance. Field experiments have been in progress on the Yale and Harvard forests for over fifteen years.

There are certain problems of forest research which can be worked out to a better advantage by a university than by any public agency. There are found on the technical staff of a large university men of great experience and technical knowledge. Such institutions are on a permanent basis and experiments can be carried out consistently over a considerable period of years. And a university always has the advantage of being completely independent in its selection of projects and in the conduct of its investigations.

The donor of these endowment funds to Yale and Harvard has made a contribution to forest research of very great

importance, whose results should count large in advancing the practice of forestry.

CORRESPONDENCE.

SIR WILLIAM SCHLICH'S SERVICES.

We are requested by Sir William Schlich to publish the following:—

Mr. E. P. Stebbing in his book "The Forests of India," Vol. II, Chapter XXI, pages 612-613, makes the following statements.—

"This volume may perhaps be fitly concluded by quoting the Government of India's farewell Notification to two of the three Inspectors-General, Brandis and Ribbentrop, who had introduced and placed on a firm footing Forest Conservancy between 1863 and 1890.

For reasons to be given, such a Notification was not issued on the retirement of Schlich, but an appreciation of his services and his work was published in the *Indian Forester* on his retirement, and appeared in other publications and Memoranda."

Again, he goes on to say in another paragraph, on page 613.

"The explanation of the absence of a Notification of a similar character on Schlich's retirement (for the Gazettes between 1884 and 1890 disclose no such Notification) is simple.

Schlich retired from service in India in 1885, but continued in active service at home up to 1889 in charge of the Forest School at Cooper's Hill, during which period he still appeared on the India list as 'Inspector-General of Forests.' Between the two duties he seems to have lost the usual validictory address."

Mr. Stebbing's statement that no farewell Notification was issued by the Government of India on my services, on my retirement from the Forest Service, is untrue.

The Governor-General in Council passed such a Notification on the 7th February 1889, and it was published in the *Gazette of India* on the 9th February 1889. I enclose a copy of it.

REVENUE AND AGRICULTURAL DEPARTMENT.
NOTIFICATION.—FORESTS.

Calcutta, the 7th February 1889.

No. 130-*F.*—The following permanent promotions are made in the Forest Department, consequent on the retirement from the service of Dr. W. Schlich, Inspector-General of Forests to the Government of India (on deputation in England), with effect from the 1st January 1889:—

Mr. B. Ribbentrop, Conservator, 2nd grade, and sub *pro tem.* Inspector-General of Forests, is confirmed in the latter appointment.

Mr. G. Mann, sub. *pro tem.* Conservator, 2nd grade, Assam, is confirmed in that grade.

Mr. C. Bagshawe, Deputy Conservator, 2nd grade, and sub. *pro tem.* Conservator, 3rd grade, Central Circle, North-Western Provinces and Oudh, is confirmed in the latter appointment.

In notifying Dr. W. Schlich's retirement from the Forest Department, the Governor-General in Council desires to place on record an acknowledgment of Dr. Schlich's valuable and distinguished services both in organising the Forest Administration in Sind and Bengal, and in developing the Imperial Department as Inspector-General of Forests.

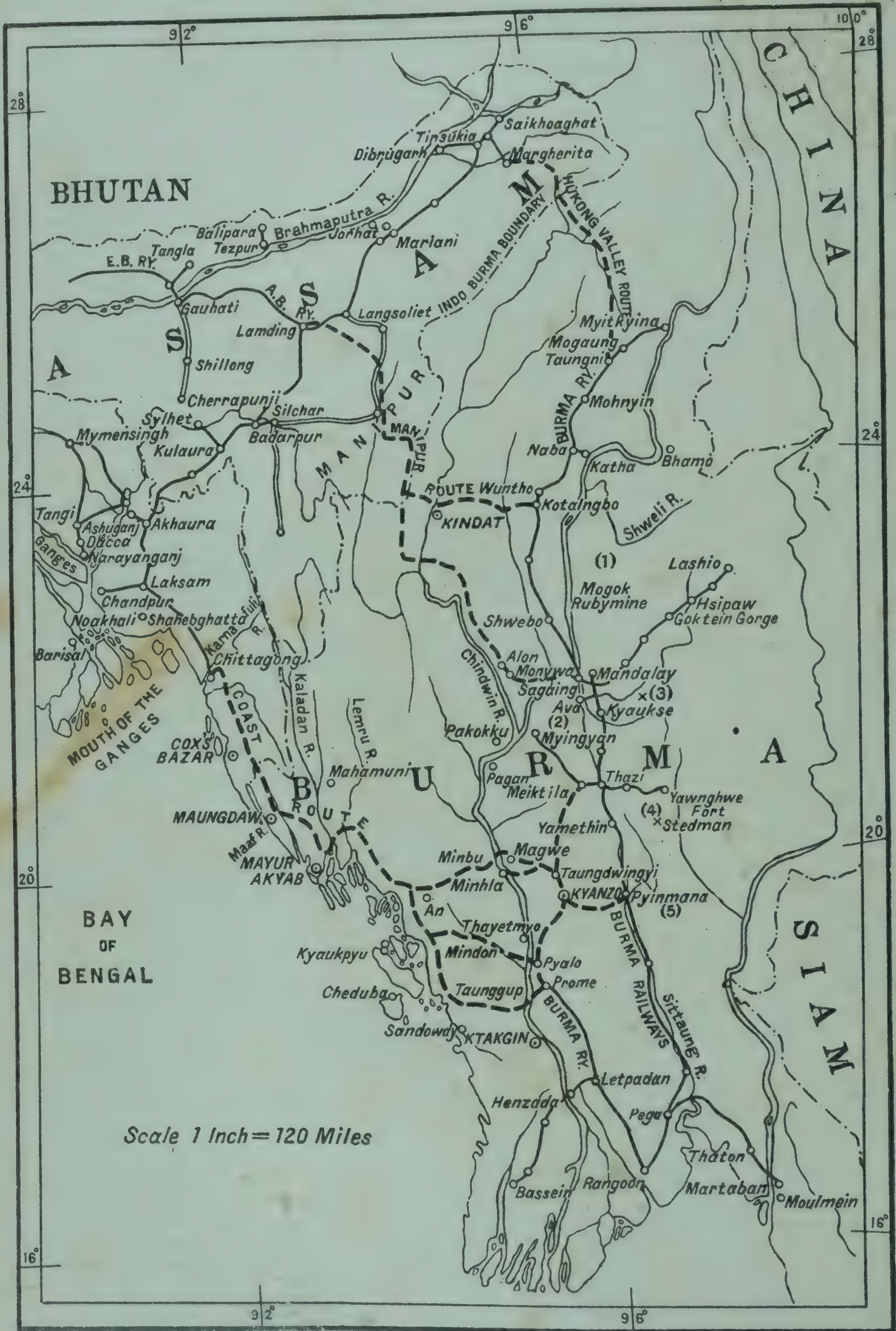
Dr. Schlich's labours to perfect the technical education of the Forest Staff deserve special notice. To him is to a great extent due the credit of having established on a satisfactory and practical basis the School at Dehra for the instruction of the Executive Forest Staff, and to a still greater extent that of having organised the Forest Branch of the College at Cooper's Hill for the education of the Controlling Staff. It is a satisfaction to the Government of India to know that Dr. Schlich's retirement does not sever all connection between him and this country, and that, as Principal Professor of Forestry in Cooper's Hill College, he will still continue to exercise a useful influence over the Forest Departments of India.

E. C. BUCK,

Secretary to the Government of India.

[A copy of this above Notification was published in the *Indian Forester* of 1889, and is to be found in Vol. XV.—V. Extracts from Official Gazettes, pages xiii & xiv.—*Hon. Ed.*]

SKETCH-MAP SHOWING THE DIFFERENT INDO-BURMA RAILWAY RECONNAISSANCE SURVEY ROUTES.



N o.7220.856.

VOLUME XLIX NUMBER 10

INDIAN FORESTER

OCTOBER, 1923.

ASSAM TO BURMA ACROSS THE HILLS.

In connection with the linking of Burma and India by railway, three reconnaissance surveys were undertaken by the Government of India in 1896; one through Manipur in Assam another through the An Pass; *i. e.*, more or less along the Arakan Coast in Burma, and the third from the Dibru-Sadiya Railway terminus at Ledo across the Patkoi Range, through the Hukong Valley. This is called the Hukong Valley route. Mr. Way, then Engineer-in-chief reported that the Arakan Coast route was exceedingly difficult and expensive, while the Military Department also had the greatest objection to the route. In 1915, the Manipur route was definitely abandoned. During the field season of 1917-18, Mr. Stevenson, an Engineer of the Assam Bengal Railway, was deputed to find out whether it would be possible to avoid Mr. Way's alignment of the Patkoi section which involved a steep gradient of about 50 miles on either side of the Patkoi ridge, and a 5,000 ft. tunnel through it. Mr. Stevenson found that by going up the Namphuk Valley further east he could include a saddle called Sympana which would not only ease off the gradient, but reduce the tunnel to about 1,000 ft. only. In 1919, a preliminary survey of the Hukong Valley route was ordered, and in the beginning of 1920, a portion of the route between Assam and Loglai Valley was surveyed. In 1921, the survey was again resumed both on the Assam and Burma side, and Mr. Allum, the Engineer-in-chief, asked the Assam Government for a Forest Officer to report on the forests along the proposed railway line. I was luckily selected for the work, on

deputation, for which I am greatly indebted to Mr. Todd, then Conservator of Forests, Eastern Circle, Assam. The Geological Survey of India also sent Dr. Murray Stuart, Superintendent of the Geological Survey, to report on the geology of the country.

Our party consisted of Mr. F. W. Allum, Engineer-in-chief, Dr. Murray Stuart, Superintendent of the Geological Survey, and myself. We had with us a sub-assistant surgeon, 12 sepoys from the Assam Rifles, and about 200 Gurkha and Naga porters for carrying our kit and provisions. At first, we did not entrust the Nagas with our personal kit, as we were not sure they would not run away with them to their mountain homes. The Gurkhas, therefore, carried our personal kit and Nagas our provisions. It must be said to the credit of the Nagas that they proved absolutely trustworthy and when at Namyung Jup* we had to send back our military guard and Gurkha porters, the Nagas were employed to carry all our kit, except cash and opium chests.

At Namchik, 18 miles from Ledo the present terminus of the Dibru-Sadiya Railway, our base depôt was established. Besides we had three other ration dumps, at Nambong (mile 40), at Loglai Jup (mile 99), and at Namyung Jup (mile 117), to pick up rations on our march. Three signalling stations were cleared, one at Namchik, one on the Patkoi ridge and the third at Loglai Jup, and communications were kept up by some of the sepoys who were trained signallers. Ration dumps were filled in advance, and a military guard was sent at Loglai Jup and two Singpho headmen to Nambong and Namyung to look after the dumps till the party reached those places.

In the Lakhimpur Frontier Tract, there is a minor Singpho chief named Bisa Yong who has great influence over the Nagas in the Patkois. Two other headmen, Bisa Ladoi and Ningrengrong also have some influence. These men were sent for, and rates for the Naga coolies were settled. The Nagas took some time to finish up harvesting and storing their paddy and when they came down to our base depôt at Namchik, they were at first employed to carry rations to our advance ration dumps. Along

* Jup means the junction of two streams.

1. A Naga chief and companion. The chief is wearing a false beard of wild pig's bristles and the two tushes on his hat.

2. The effect of dynamiting a pool in Sadu-jup, Mytkyina frontier.

Photo-Mech. Dept., Thomason College, Roorkee.

3. Our camp in the forests, at Namyung-jup.

Photos by R. N. De. P.F.S.

4. A group of Naga maidens.

with the carriers, came some Naga chiefs and mates or *sardars*. A chief, Morum Lakhim by name, was with us till we reached Namyung Jup. The chief of Sagwan also sent his son to accompany the party. These chiefs were given free rations and 2 annas commission per head of coolie under him. The mates were paid Re. 1-4 per day, and grown up men and women were given Re. 1 daily. For young boys and girls, the rate was 12 annas. Photo 1 shows a Naga chief with his true Naga head gear and false beard!

Having completed these arrangements we started for our journey on the 23rd December, 1920. From Namchik, we followed the Namphuk river up to Nambong Jup and then turning to the right followed the Namkri stream. We reached the top of the Patkoi ridge on the 30th of December at an elevation of 4,100 ft., about one mile east of Way's Pass. Patkoi is the water-parting between Assam and Burma. The view of the surrounding country is magnificent; towards the south of the ridge, the waters of the Noongyong lake were glittering in the bright winter sun and on the north a beautiful panorama of innumerable hills dotted over with Naga *jhums** and villages Under the auspices of the Railway Survey, a party of surveyors were sent by the Assam Hydro-Electric Survey Department to ascertain the possibility of a hydro-electric scheme by putting a bund across the Noongyong river, the only outlet of the lake The Noongyong lake is about 2 miles long and one mile wide and very swampy along the edge. The Nagas were very much afraid to go near the lake, the shores of which they told us, were teeming with wild animals of all kinds. They believe that it is haunted by ghosts and goblins.

The forests up to the foot of Patkois are of the usual evergreen type found in these parts, *Mesua ferrea*, *Terminalia myriocarpa*, *Dipterocarpus pilosus*, *Shorea assamica* and *Quercus semiserrata*, being the common species. There are many *jhums* in this part of the country. The character of the forest altogether changes on the Patkois and a different flora is noticed, the chief species being *Quercus pachyphylla*, *Q. spicata*, *Q. Thom-*

* *Jhums* mean patches of shifting cultivation.

soni, *Castanopsis* spp., *Prunus* spp., *Ilex* spp., etc. Unlike the Himalayan oaks, Patkoi oaks have clear boles up to an average of 40'. The Nagas who inhabit those hills use them very largely for beams, rafters, etc., for their dwelling houses. Wild tea is found on the Patkoi in places, and I believe it is here that wild tea was first discovered. We halted on the Patkoi ridge for two days which were utilised in clearing a temporary signalling station and building up a ration dump. What with the chilly wind and occasional rain, life on the Patkois was not by any means comfortable, and I, for one, was right glad to get away from there.

From the southern slope of the Patkois we got into the tribal territory under the nominal control of the Political Officer of the Sadiya Frontier Tract.

The tribes in these parts are still confirmed head hunters and we noticed many heads of enemies, brought home as trophies, hung up in the verandahs of the houses, and we were not quite sure that, in case the whole tribe rose against us, our skulls would not add to the grandeur and beauty of some Naga parlour!

We reached Loglai Jup *viâ* Noongyong and Digum on the 8th of January, 1921. In the Loglai Jup, we came across the first Singpho village called Wakhet. Nagas who live on the Assam side of the Patkoi ridge are under the control of the Government, but those that live on the southern side do not pay taxes to anybody, but all of them recognise as nominal overlords the Singphos who live in the Hukong Valley. In this connection an amusing incident took place. While at Namyung, a well dressed young Singpho came to our camp and demanded commission from us for employing Nagas. The Engineer-in-chief flatly refused to entertain his claim. On seeing military guards and our large force, he thought that discretion was the better part of valour, and quietly left the camp. Loglai Jup is the junction of the Loglai and Turong rivers. Here we noticed a few Indian coolies who had been kidnapped by the Nagas from the tea gardens of Assam and sold to the Singphos, as slaves. Major Reich of the Survey of India who visited those parts in connec-

tion with some survey operations going on at the time, very kindly took the initiative and with the help of the Government rescued some of these men, both here and in the Hukong Valley, but others wanted to stay on willingly as they had taken Singpho wives and settled there.

From Loglai Jup onwards we followed the Turong river practically all along up to Sarrow, except for a short length.

The character of the forest is almost the same as that on the northern side of the Patkoi ridge. All along our route from Namchik to Sarrow, there are some excellent pools in the Namchik, Loglai and Turong rivers where plenty of fish mostly of *mahseer* variety are found. Our record catch was a 30 lb. *mahseer* caught by Dr. Murray Stuart in the Rikaw Jup with a rod and line. Nagas come down in large numbers in the valleys in cold weather and catch fish with nets, or by poisoning the pools. Some specially good pools are their preserves, which we spared from dynamiting at their request. Necessity knows no law. We had to feed our coolies with meat or fish to prevent scurvy among them, and as we could not get much *shikar* in the forest, we had to have recourse to dynamiting some of the pools after every few days. Our average was about 15 lbs. of fish per cartridge. The largest sized fish could scarcely be secured, because, though stunned, they would lie down at the bottom of the pool. This fish diet, I am glad to say, kept our Gurkha and Naga porters in good health and lively spirits, and in their attempts to catch fish, more than once, some of them had gone beyond their depths and would have found a watery grave but for our prompt rescue. Photograph 2 shows fish caught by dynamiting.

Very few wild animals were noticed in this section. We were told that Noonyong lake and its vicinity abounded in game but we could not go there for shooting. Green and imperial pigeons, and barking deer were the only creatures we shot. Our usual amusement after nightfall was playing a gramophone. Harry Lauder's comic songs, Tobermory and others, never failed to tickle our Naga and Singpho audience, and were a great relaxation for us also.

We reached Namyung Jup on the 16th of January and halted for 3 days to pick up our provisions and a new batch of Nagas who could relieve those who had come so far. We also sent back all our Gurkha porters from here, as they were required for Railway survey work on the Assam side of the Patkoi. From Namyung Jup onward the Turong river passes through a gorge which is one of the greatest obstacles to the passage of a railway. Photograph 3 shows the nature of the country and the forest.

Coal and petroleum have been reported to occur in the Naga country. Some Nagas told us that in the Shagwan Naga country they found a kind of boulder which weighed twice or three times more than an ordinary boulder of the same size. It is suspected that those boulders might contain platinum. The Gedu river brings down a mineral named Jadeite (Jade of commerce). It has got a beautiful green colour and is highly prized by the Chinese and the Burmans. Our Nepali porters somehow knew this fact, and everyone collected 10 to 15 seers of quartz and other pebbles that had a slight green colour. They were under the impression that they would rapidly become millionaires when they would sell these precious stones at Mogaung. But their disappointment could be better imagined than described when after carrying this extra weight for about a fortnight, they consulted Dr. Murray Stuart and were told that almost all of them were anything but Jade!

Before we left Namyung Jup, we made sure that we had sufficient rations to last up to Sarrow as there were no villages along our route within a reasonable distance. Nagas were also asked if they required any rice, and it was supplied to those who wanted them. After we had marched for about 8 days, they complained that their rice supply was getting exhausted and we were faced with a grave situation. We had no idea how far above Sarrow we would meet the Burma section of the Railway survey party and we took just sufficient provisions for us only to reach Sarrow as we had rather limited number of Nagas at Namyung. But we had to take the risk and issued provisions to the Nagas for two days only. Fortunately on the 27th, we met the Burma section under Mr. Jackson, Executive Engineer.

I give a short note collected in the evenings round camp fire, through my interpreter about the Nagas of the Patkoi Range. The Patkoi Nagas are divided into the Morang, Moshang Langsing, Sarthey, Shagwan and Tonglim clans. The various clans, speak different languages, but most of them can understand the language of a neighbouring clan and some of them can speak Singpho. They are a Mongolian race and live in hou ses built on platforms supported by wooden posts. They usually use bamboo and palm leaves to thatch their houses but occasionally thatching grass is also used where available. They are quite a healthy people, but one would at once notice comparative scarcity of children in the villages. This, I believe, is due to the fact that the girls are married at rather a late age owing to the large amount of dowry a man has to pay before he can secure a bride. The usual dowry consists of rupees one hundred and forty in cash, one buffalo, one pig, one bull, a gong of copper, two barrels of wine and a gun. Ordinarily, the age of marriage of a girl is about 20 years, but it is sometimes as low as 14 or 15 years, if both the parties are of the same age. A youth wishing to marry, selects his own bride and wins her. Courting forms an essential part in a Naga marriage. Even if a man has got the requisite money, he may not be able to marry unless he can win a girl's affections. Every unmarried girl has a small bamboo reed flute called *pow* hung round her and carefully concealed under her clothes. This instrument has got a very low sound, and can only be heard if played near the ear. If a girl falls in love with a young man, she plays the flute near his ear, in some secluded place, usually near some watering place. Abduction of a girl before marriage to the house of the young man she loves, is not unusual but her parents must give consent to the marriage, or the girl will have to be returned. No marriage can take place without the consent of the parents of both the parties. It often happens that a young man has wooed and won a maiden, but is too poor to pay the price for her, in such cases marriage may take place provided the parents are willing, but the marriage debt has to be paid, either by giving a girl from the husband's family in marriage to a youth in the wife's family, or by instalments in cash and

kind. The girls most sought after, are those that know weaving, pounding rice and cooking.

The usual prohibited degrees of marriage are :—Step mother, brother's daughter, father's sister's daughter, uncle's daughter, mother's brother's daughter, step-mother's sister, aunts. Photograph 4 shows a group of unmarried Naga girls.

Nagas grow rice, poppy, gourd, sweet potato, yam and a few other vegetables in their fields. They sometimes add spices also, to give their vegetables a flavour. But this spice is altogether different to the ordinary article. It is an insect, a kind of *Rynchota* that is found under pebbles in dry river beds. When this bug is pressed it gives a very offensive smell, but the Nagas like it immensely, and these bugs add flavour to their delicacies which would otherwise be spiceless! Whenever we halted for a day or two, it was a sight to see the Nagas busily engaged in collecting and storing these bugs in hollow bamboo culms. The Nagas are very fond of meat. They eat all sorts of domestic animals including the flesh of dogs. Once even a pine marten shot by me provided them with a delicious dish.

The Nagas have got interesting folk-lores. I will mention only one story here, which is about the sexes of the sun and the moon. At first the moon and the sun were brother and sister. The moon knew certain magic by which he could convert vegetables into meat. At the request of the sun, he told her the secret, but warned her not to give this out to anyone else; the sun in her usual feminine indiscretion revealed this to a monkey who disclosed it to all animals. At this, the moon got very angry with the sun and abused her. The sun took this to heart, and in her anger gave out so strong a heat that all trees were dried up thereby. One of the dry branches fell on the moon while he was sleeping underneath, and he was killed. The sun also died of the shock of her brother's death. When they were reborn the sun became masculine and the moon feminine.

We resumed our march on the 30th January and reached Siluk Jup in the evening. There is a salt spring on the hill from which the Siluk takes its rise, hence the stream is called Siluk Kha. Singphos of the Hukong Valley come up here every year

5. Bamboo raft on the Tanai river, Hukong valley.

6. Singpho house under construction, at Maingkwan, Hukong valley

Photo-Mech. Dept., Thomason College, Roorkee.

7. A bamboo bridge in the Hukong valley.

Photos by R. N. De. P. F.S.

8. The Singpho chief of Wallabum, Hukong valley, with his wife and retainers

by boats, and make salt by boiling down the spring water. This is their only source of salt near by. From Siluk Jup the Turong river is fairly safe for boat-journeys. I had a bamboo raft made for me, and from this place onwards I always shifted camp on my raft till we reached Sarrow on the 4th February. Photograph 5 shows a raft on the Tanai river. Sarrow is the entrance of the fertile rolling plain, known as the Hukong Valley. The total area of the valley is about 1,600 sq. miles, of rich loamy soils, "ready to laugh into a harvest when tickled with a hoe," as Mr. Allum puts it. The country is inhabited by a Mongolian people, called Singphos or Kachins. They are like the Nagas in appearance but are much more active and intelligent. They also build their houses on platforms, but these are very long and divided into compartments, so that several families can live in one house. Photograph 6 shows a typical Singpho house in the Hukong Valley under construction. They are great experts in thatching and other domestic works. I saw houses thatched with bamboo, palm and *Amoora spectabilis* leaves, and was told that they were water-proof. Singphos can make bamboo bridges of various designs of which photo 7 is a specimen. The staple crop of the Singphos is rice, but they also grow pulse, poppy, mustard, tea and tobacco.

The Hukong Valley is divided into several tribal territories, each chief having authority over his own clan. Their institutions are much more developed than those of the Nagas. Much information about the Kachins may be obtained from the excellent book written by Mr. H. F. Hertz, Deputy Commissioner of Mytkyina District. Unlike the Nagas who burn as well bury, the Singphos only bury their dead. Death, specially of a well-to-do man, is made a great occasion for drinking and dancing. A gun is also fired at intervals to announce the news of the death in the neighbouring villages. Hukong Valley has no valuable timber. The only forest produce of any importance is rubber (*Ficus elastica*). But, owing to the slump in the rubber market, tapping has been discontinued.

On our way to Shadu Jup, we passed Maingkwang and Wallabum, two most important and prosperous villages in the Hukong

Valley. In Maingkwang, one can buy rings, buttons and other small articles of amber worn as ornaments by the Assamese, Singphos and Nagas. This amber is the fossil resin of the extinct coniferous and other resinous trees that are found in the Miocene clayey beds of this valley. An amber mine is situated at a distance of 4 miles from the Lalaung village, the chief of which owns the mining areas. He lets out an area of about 10 feet square for Rs. 10 for digging out amber. There is no indication at all on the surface of the ground by which one may know where the mineral will be found. The so-called mine is nothing but a well about 6 ft. in diameter, dug vertically for 30 to 40 ft., within which amber is usually found. It often happens that after digging the whole depth, one does not find the mineral and all the labour is simply wasted. So this amber mining is a sheer gamble. Besides amber, flint is also found in these formations, but it is put to no use by the Singphos, except for lighting fires.

Before we reached Maingkwang, we crossed the Tanai river. This, as well as other small streams, bring down gold dust in their sands. Some Singphos make a living by washing gold and they are reported to earn about one rupee per day.

The next place of importance we visited was Wallabum. The chief of this place is a very influential man and has got a large number of slaves and retainers. This chief with his coat of honour presented to him by the Engineer-in-chief, together with his wife and retainers, are seen in photo 8.

From Wallabum onward, our journey was uneventful and we reached Shadu Jup, the first British Military outpost on the Burma frontier, on the 26th February. From Shadu Jup, the type of the forest changes and deciduous takes the place of evergreen, but teak did not make its appearance till we came to Laban. There is a popular belief that teak does not grow north of Mytkyina, but I found it growing about 25 miles north of it. Though originally perhaps, teak was introduced in the Buddhist monasteries, they are now reproducing naturally like any other teak in the district. We reached Kamaing, the headquaters of the sub-division, on the 10th of March. About 32 miles west-north-west of Kamaing are the well known jade mines of Tammaw, which

a prosperous little place. Jade found there is brought down to Mogaung by mules or boats. We left Kamaing on the 11th and reached Mogaung on the 12th. Mogaung is a railway station of the Mytkyina branch line, and is also the sub-divisional headquarters. This brought our journey to a close. The total distance we travelled was about 300 miles. In spite of the usual inconveniences one feels in this kind of expedition, through unknown and unsurveyed country, we had a most interesting and enjoyable journey and we were really sorry to find ourselves back again in civilised parts so soon.

R. N. De, P.F.S.

FROST AS A CAUSE OF UNSOUNDNESS IN SAL.

When recently touring in charge of a class of Ranger students it occurred to me that some interesting results might be obtained by felling and examining sal trees which had been damaged by the severe frosts of 1904-05, the effects of which are still plainly visible in many forests throughout Northern India. The frost of that year was so unusually severe that sal were cut back over large tracts where in normal years there is no damage whatever. Several Forest Officers at that time recorded the results of their observations in the *Indian Forester* and I think the following notes which I have extracted will help the reader to picture more accurately the exact nature of the damage which took place.

Mr. E. R. Stevens describes how throughout the Dehra Dun and up to a definite elevation on the slopes of the Siwalik range the sal forest was affected, though in varying intensity according to aspect, density and elevation. On older sal the twigs and thinner branches only had been killed, whilst poles 1 to 2 feet in girth had been killed to within 5 to 15 feet from the ground and stems under 1 foot in girth had been killed to within a few feet from or down to the ground itself. Mr. E. A. Courthope writing of the sal in the Saharanpur Division says—"Saplings have either died from the ground upwards, in which case they are sending out shoots from their roots, or they have been killed from

the crown down to a varying distance, in which case their boles are surrounded by a mass of epicormic shoots above which the dry stick which formed the leading shoot before protrudes. It still remains doubtful what the after-effects of this damage will be. It is stated by some that when the dried part falls off, one of the epicormic branches will assume the lead, in which case after a few years very little perceptible difference would be seen. Others believe that several of the epicormic shoots will assume the lead simultaneously, thus causing a sort of pollard." This was written towards the end of the hot weather following the frost. The Conservator of Forests, Oudh Circle, also wrote that in the Pilibhit Division sal trees up to 35 feet in height had in some cases been killed and that the frost had penetrated right into the forests and killed off young sal trees under a fairly dense canopy. As regards Bengal Mr. A. L. McIntire states that no damage was done to sal in the Duars and Tarai tract, but that in depressions in the Palamau and Hazaribagh Districts it had suffered to a greater or less extent, the damage varying from the killing of the outer twigs only, or of the lower or top branches (*sic*) only, to killing outright down to ground level of trees up to 50 or 60 ft. high. In the Palamau reserved forest about a quarter of the sal-bearing area was estimated to have suffered in this way.

For the purpose of my investigation two sal areas were selected in which the damage was as severe as any to be seen in the neighbouring forests, and there is little doubt that the crowns of all sal trees in both these areas had been cut back. One area was situated close to the north edge of the Gola Tappar about a mile from Gola Tappar bungalow in the Dehra Dun Division. The elevation here is 1,200 ft. The ground is nearly level with an almost imperceptible slope to the south-east. The sub-soil is deep and composed of recent deposits of boulders, gravel and sand with a fair percentage of clay. The forest, owing partly to cleanings and thinnings contains little besides sal in the overwood, and the underwood is generally open. The average density is however fairly good. The other area borders the Sitabani-Ramnagar cartroad about a mile from the Sitabani bungalow in the Ramnagar Division. The elevation is 1,700 ft. The ground slopes

gently to the south where at short distance the lower level of the Jamanpani Sot, causes the character of the forest to change abruptly. The soil and type of forest are generally similar to that of the Gola Tappar area.

In the Gola Tappar area 30 trees were felled and examined; in the Sitabani area 25 trees were taken. The trees selected averaged 8 to 9 inches diameter at breast height, the smallest being 6, the largest 12 inches diameter. The average height of the Gola Tappar trees was 62 ft. as compared with 61 ft., at Sitabani, no tree in either case being less than 50 or more than 70 feet high. The stems had been cut back by the frost to an average height of 31·5 feet in Gola Tappar and 26 feet in Sitabani, the height ranging from 21 to 42 feet in Gola Tappar and 15 to 42 feet in Sitabani.

Every tree had sent up new and vigorous shoots from close to the point to which the stem had died back. In 60 per cent. of the cases the shoots were single, in 39 per cent. two leaders had been produced, and in 1 per cent. (actually one tree out of 55) three leaders. These shoots averaged 6 inches diameter at base and 30 feet in length at Gola Tappar and 5 inches diameter by 35 feet long at Sitabani.

Both in Gola Tappar and Sitabani half the trees investigated showed signs of a more or less occluded channel down one face. The visible portion of this scar averaged 2·5 feet in length, but never exceeded 8 feet. It is apparently due to the cambium dying on one side of the stem to a lower point than the other. Unfortunately no observations were made to determine whether the position of the scar is correlated with the points of the compass. Had this been done it might perhaps have been possible to explain the phenomenon on a scientific basis. As occlusion of the channel proceeds, the central portion of the stem is usually found to be quite hollow and forms a most effective water trap.

With one single exception rot had invariably spread down the stem from the point to which the stem had completely died back. In three cases (one at Gola Tappar and two at Sitabani) the rot had extended down to the very base of the stem, the

average distance being 9 feet in Gola Tappar and 10 feet in Sitabani, or about 9′ 6″ for both areas combined. In recording the measurements any decided discolouration of the wood was usually considered evidence of the presence of decay, though it was necessary to exercise considerable discretion in doubtful cases. Every stem was split open longitudinally and the decay followed down from its source. This was found to be a most necessary precaution as unsound tissue in the lower portion of the stem could often be traced to the decayed bases of dead or dying side branches, and unless the decay had been followed down from the very top, unsoundness due to varying sources might easily be confused.

In 29 per cent. of the new shoots, indications of unsound tissue running up the centre of the stem were detected. The origin of this decay was, however, sometimes open to question and it was often difficult to decide whether the slight discolouration was really due to fungus or to other causes. Though in most cases it appeared as if the rot had spread upwards from the decayed tissue in the old stem, too much reliance should not be placed on this result.

These investigations then appear to have clearly demonstrated three points :—

(1) About 40 per cent. of affected stems produce at least two well-developed leaders.

(2) When a stem has once been cut back it may be confidently assumed that unsoundness will infallibly result.

(3) This unsoundness extends down the stem at an average rate of 6 inches a year.

In considering the practical application of these results it will be noted that the investigation only covered trees ranging between 6 and 12 inches diameter. The investigation should be extended to include larger girth trees, but the results already obtained seem to justify one asking what chance there is of obtaining a fair proportion of sound timber when working these forests as at present on a rotation of say 100 years.

I leave the reader to draw his own conclusions, and perhaps they will be none too comforting to those who have just completed working plans for these and similar areas. The optimist may argue that such forests are quite abnormal and that no forester can take into account the possibility of their recurrence. There are, however, no data from which the probable frequency of such abnormally cold years can be estimated with any certainty, and a wise forester will scarcely dare to trust the entire failure or success of his crop to the vagaries and uncertainties of the climate. Colonel Pearson, writing in the *Indian Forester* for June 1905 says that during his Indian experience he recollects two instances of excessive cold in the Central Provinces, one in January 1860 and the other in March 1864. But whatever the verdict may be as regards the best form of future management for these forests no one will dispute the fact that the sooner this rotten material now standing in our forests is replaced by a sound crop, the better.

A. E. OSMASTON, I.F.S.

SYSTEMS OF SALES OF TIMBER IN THE U. P. FORESTS.

There are two main systems at present for the disposal of timbers in these provinces, namely, "The Monopoly plus Royalty" and the "Lump Sum Sales."

MONOPOLY PLUS ROYALTY SYSTEM.

The present disadvantages of the Monopoly Royalty System.—This system which is supposed to be the best, is not only becoming daily unpopular with our contractors, but is, at times, a source of unnecessary worry to forest officers for the following reasons :—

It is somewhat complicated and hence not liked by the majority of the contractors especially the newcomers. In fact a certain class of men belonging to Delhi, Rohtak and Meerut districts known as *khatris*, who were probably the first to take, advantage of this system, when it was originally introduced, have its monopoly throughout the Province, while the indigenous

contractors have been practically debarred from the green timber works and are limited to Lump Sum Sales of fuel and second year fellings.

The guarantee of the probable yield, which is given to the contractors at the time of auction is a great source of trouble, both to the forest officers and the contractors. In the first place it is very difficult, if not impossible, to estimate correctly, the probable yield of a coupe in the absence of any reliable yield tables, and when our forests are so extremely abnormal, that the yield tables or the experience of an officer gained in one particular locality is hardly of any practical use in another locality. Besides this, the information about the lengths of boles and the differentiation of sound and unsound standing trees supplied by the marking officers is hardly ever satisfactory, being largely based on mere guess work and varying according to the experience of the man. This record of marking officers serves as the basis on which our yield is estimated and guaranteed, with the result that if it is correct it is only so by chance. In majority of cases the actual yield either far exceeds or else falls below the guaranteed estimate. Sometimes the difference is very great, which not only brings discredit to the man who prepared the estimates of the guaranteed outturn, but there also arises a serious question of the refund of monopoly money in proportion to the shortage of the outturn. When such cases are abnormally frequent in any particular year the Divisional Forest Officer, besides getting a bad name, is worried a good deal by the contractors for refunds, which is a matter, which has probably to be decided by the Conservator.

Demand for refunds.—The contractors sometimes not only demand a refund on account of the shortage, but some compensation as well, on the plea that they have made arrangements for sawyers, carters and provision, etc., on the basis of the guaranteed yield, and have lost a good deal in making unnecessary advances. Such arguments are perfectly reasonable, but only in cases when the shortage is considerable.

Loss to Government.—In cases when the guaranteed figures are far exceeded, which is by no means uncommon, Government suffers a distinct loss by receiving no monopoly on the excess

outturn, while in cases of shortage contractors lose confidence in the guaranteed system and the bids are correspondingly low the following year, even though the estimates may have been prepared most carefully and may have been under-estimated.

New System suggested.—The system suggested is the sale of timber by *Royalty* only on the following lines:—

As in the existing system, an approximate estimate of the probable outturn of the coupe will be prepared, but will not be guaranteed. The abstract of the marking results of each coupe showing the number and species of trees marked by girth or diameter classes will be given to the contractors at the time of auction as usual, with all the necessary information required, for their guidance. According to the growth of the forests the species will have to be divided into two main groups for the facility of auction, *viz*., the principal and most valuable species concerned, being put in one group and called by its name, for instance sal in the plains of northern India, while its less valuable associates of more or less equal value being all put together in another group and called *miscellaneous* species. The contractors at the time of auction may be asked to bid on these two groups separately, as to what maximum price per c.ft. they can afford to offer to Government, without the least regard as to what the outturn of the coupe under sale would be. The approximate estimates of the yield being given merely to facilitate the arrangements of the work for the contractors.

Possible difficulties.—There is no doubt, it will afford some confusion, when sal is purchased by one contractor and the miscellaneous by another on the same area, but it will not be entirely a new thing and can be managed. Since the creation of the Utilization Circle, sal and *haldu (Adina cordifolia)* have often been sold to different contractors on the same area.

The other drawback seems to be the combining of the two neighbouring contractors, having different royalties to pay, which will induce the man with higher royalty to pass his timber under the name of the other with lower royalty. But this drawback is more imaginary than real, as this inducement is also possible in the present system, that is to say, the man with a higher

monopoly per c.ft. may pass his timber under the name of a neighbour with a lower monopoly and thus reducing his yield below the guaranteed estimate, may obtain a refund to the advantage of both himself and his neighbour. Obviously this defect is of no importance and may be controlled through the felling staff as it is done now.

Expected advantages.—The contractors instead of paying the price of the coupe by instalments, will deposit sufficient Royalty in advance to keep their export going, and there will be no difficulty about realising the last instalment, such as is sometimes experienced under both the existing systems. This system it is hoped will give equal chances to all commers and break the monopoly of the *khatris* (particular class of contractors) which is another source of trouble, as they tend to combine. It will be fair both to the purchasers and the department without any chance for the grievances of the former and the worries of the latter, regarding the guaranteed outturn or the refund.

LUMP SUM SALES.

Disadvantages.—The second system by Lump Sum is a sort of gamble, often resulting in abnormal profit or loss to the contractor. It is, therefore, not suited for the sales of sawn timber which is the main source of our revenue. It is also often difficult under this system to realise the last instalment.

Advantages.—It is very simple and is best suited to fuel and other minor second year operations, with a view to clear the coupes of all the miscellaneous stuff left after the main fellings, or where the kind of the produce is of a more varied nature

Possible Modification in the present Monopoly Royalty System.—In case the proposed purely Royalty system may not be considered suitable for certain reasons, a modification in the present Monopoly Royalty System is at least very desirable for smooth working. That is, the present scale of Royalties on various timbers may be enhanced to its maximum capacity, thus leaving a mere nominal margin for monopoly bids at the time of the auction. This will reduce the chances of abnormal profits and losses on either sides and the refund of monopoly if any will also be nominal.

Considering all the above points and the advantages and disadvantages connected with the present Monopoly and Royalty or the Lump Sum Systems, the suggested pure Royalty System or the modified system will be much simpler both for the contractors and the forest department and the chances of excessive profits being made by either Government or the contractors will be reduced to a minimum, with a consequent reduction in the legitimate grievances of the contractors and the difficulties of the forest officers.

MD. HAKIM-UD-DIN, P.F.S.

OXIDATION OF TANNINS IN MYROBALANS.

Brief summary.—It has been found that the tannin content of myrobalans is considerably reduced by the ordinary process of drying, as a result of enzyme and other activities going on in the cell. This harmful effect has been obviated, by cutting the fruit in slices and drying. A much improved product is thus obtained, which gives clear aqueous solutions and these do not deposit ellagic acid so quickly. The use of antiseptics with a view to preserve the myrobalans against the destructive action of fungi is also recommended. Dr. Mann's researches on the fermentation of tea having already established that the chemical reaction consists essentially in an oxidation of the tannin, as a result of certain oxidases and peroxidases; it occurred to the author to investigate whether similar changes take place in the ordinary drying of myrobalans, a process which extends from 15—20 days, is there any considerable fall into the tannin content, and if so, could it be avoided?

The following experiment was therefore performed :—

1. Some chebulic myrobalans; (*Terminalia Chebula*) commonly known as *harr* were plucked when almost ripe in March last. Half the quantity was crushed and dried in shade—an operation which took three days. The other half was left to dry, with the skin of the fruits intact, and took three weeks for a satisfactory drying. Both samples were powdered, dried at 100° C and the tannin estimated as gallo-tannic acid.

The 1st sample thus yielded 27·5 per cent. gallo-tannic acid.
The 2nd „ „ 20·0 „ „ „ „

In the second case, it was also noted that considerable quantities of brown colouring matter is formed as the result of tannin oxidation and later on that the aqueous solution is more liable to a quick deposition of ellagic acid.

The obvious solution of the problem was to hasten the drying of myrobalans.

2. A fresh sample of chebulic myrobalans was therefore collected. One ha'f was crushed and dried in shade. The other was cut into small slices (4—6 according to the size of the fruit) and dried similarly.

The tannin content in the former case was found to be 27·5 per cent. gallo-tannic acid, that in the latter being somewhat higher— from 28 to 28·5 per cent.

To all appearance the second product was an improvement on the first and it was thus established that in order to preserve the maximum amount of tannins in myrobalans, the fruit should be cut into slices and dried quickly. The product so obtained has a light yellow colour and retains the peculiar aromatic smell, characteristic of the fruit, as contrasted with the present market stuff, a dark brown mass, with no or in some cases even a sour odour.

Experiments similar to the above were performed with emblic myrobalans (*Phyllanthus Emblica*) known in these provinces as *aonla.*

The tannin content of a sample of sliced myrobalans dried in shade was 24 per cent. gallo-tannic acid, while that of a similar sample allowed to dry with the skin of the fruits uninjured, was 22·0 per cent. gallo-tannic acid.

Some experiments on the use of antiseptics in the drying and preservation of myrobalans were also performed with a sample of *Phyllanthus Emblica.* It was noticed that the moist myrobalan slices are liable to be infected by *penicillium* and this fungi under conditions of moisture rapidly spreads and destroys the tannin. The following will give an idea of the rate of destruction.

In a sample of crushed and dried *Phyllanthus Emblica* the tannin content was originally equivalent to 51·2 per cent. gallo-

tannic acid. The same sample was moistened with water and inoculated with *penicillium*. After four days the tannin content was only 28 per cent., considerable amount of yellow colouring matter was developed and the aqueous extract rapidly precipitated ellagic acid in flakes.

Investigation showed that the infection and subsequent destructive action of the fungi could be avoided by the use of a minimum of ·5 per cent. toluene or ·25 per cent. of phenol or treatment with sulphur dioxide.

A few general observations in the end might not be out of place. The export of chebulic myrobalans in 1919-20 was 1,858,000 cwts. valued at Rs. 1,01,31,000. If the method of preservation outlined above be followed, their present tannin content would be increased by at least one quarter as much again, and if the myrobalans are valued for the tannins alone, such a course would materially benefit the trade. The exact significance of the work would be more adequately realised when we come to the tanning extracts, an industry very likely to develop in the near future. Here the value of a tanstuff is adjudged by the ratio between the tannins and the soluble non-tans and if therefore we obviate the conversion of 15—20 per cent. of our tans into soluble non-tans, the strength of our tanning extracts would be doubly greater.

A factory thus handling large quantities of myrobalans would find it advantageous to chop the fruit and pass it through a continuous rotary drier, through which are drawn hot flue gases, admixed with a small percentage of sulphur dioxide, by means of an exhaust fan. Working in double or triple "effect" would probably be more economical. The product thus dried and disinfected, would be safer to store and more convenient to handle.

ADDENDA.

Although the present knowledge of the chemistry of tannins does not warrant any rational explanation of the interesting sequence of changes going on in the cell, as indicated already still a few lines might be hazarded, as the result of some thought and observation.

The following is a set of analyses of two samples of *Terminalia Chebula*. A is the fruit allowed to dry intact and thus decay

by respiration. B is the fruit sliced and dried rapidly (needless to state, both samples are taken from the same lot):—

A.		B.	
Tans	26·1 per cent.	Tans	30·7 per cent.
Non-tans	26·9 ,,	Non-tans	22·1 ,,
Insolubles	40·2 ,,	Insolubles	40·4 ,,
Moisture	7·8 ,,	Moisture	6·8 ,,

Expressed on the anhydrous material these figures would stand as follows:—

A.		B.	
Tans	28·3 per cent.	Tans	32·9 per cent.
Non-tans	28·1 ,,	Non-tans	23·7 ,,
Insolubles	43·6 (by difference)	Insolubles	43·4 ,,

We have now to consider:—

(1) That the presence of tannin prevents pectic transformation and fermentation of sugars.

(2) That the ratio of Co_2 evolved to that of oxygen absorbed in course of respiration, is in this particular case 2 : 1 nearly.

(3) That respiration is in almost all cases accompanied by hydrolytic activity and further oxidation of one or more of the decomposition products generally follows.

(4) That the sum of tans and non-tans in the above case, is almost the same in both instances.

It might, therefore, suggest itself, that in course of respiration of myrobalans complex tannins are first hydrolysed to simpler units (such as digallic acid for gallo-tannins) and these are further oxidised by protoplasmic or enzymic activity, with the formation of non-tans as represented below:—

$$2\,(R-CooH) + o_2 = 2\,(R-oH) + 2\,Co_2$$

Tans 1 Vol of o non-tans 2 Vols of Co_2

The author wishes to express his indebtedness to Mr. M. B. Hudlikar, M.Sc., for much valuable discussion on the subject.

A. N. SRIVASTAVA.

A MAN-EATING TIGER BAGGED.

On account of the Agency trouble (Fituri) I was unable to go to my Division, Upper Godavari, until 18th of December instead of the middle of October as usual.

Christmas-week was spent by me in delightful tiger and panther-country and, though I was not lucky in so much as getting a tiger kill, I bagged two full-grown male panthers—one on the 28th of December at 3-30 P.M., which taped 6′—8½″ and the second four days later at 7-30 P.M., which measured 6′—11″: both were shot over buffalo kills, which had been tied up by me for tiger. About the middle of January I received a letter from the Conservator informing me that he would tour in my Division from about the 8th of February, so I had to change my programme and return to my head-quarters. En route I camped for a few days at Murmur—the favourite haunt of a man-eater—and narrowly missed getting him or he me? (on 28th January 1923). I shall here relate exactly what occurred:—

I had made an early start on the morning of the 28th and after inspecting portions of one of the reserves came out of the forest on to a reserve line, which also served as a cart-track, and found the pugmarks of what seemed a very large tiger, which I concluded must have passed there during the early hours of the morning. My shikari peon, the Murmur village Koya headman and "Nimrod" and a Forest-guard were with me and the latter informed me that these were the pugs of the noted Murmur man-eater. I naturally asked them how they knew. Whereupon the headman with a broad grin and much scratching of the head replied that he could identify the pugs as well as the "*Doragaru's*" (gentleman's) face, for hadn't he often seen the man-eater and hadn't he often noted the pug-marks when he and his men had to trace out and recover the body of some poor unfortunate of his village, who had been carried off by the man-eater! I was still very sceptical about it since the cart-track and the pugs were leading in the direction of my camp, I thought I would see where the tiger had gone to: it must have been about 10-30 A.M. now. After walking for about a quarter of a mile along the cart-track I heard some rustling—the forest was getting dry and there was a fair amount of dry leaves on the ground—about thirty yards in

the jungle on my right and thinking it was spotted-deer instructed my peon and the others to work round and try and drive them on to the cart-track towards me. They carried out this manœuvre quite smartly, but the deer were smarter and gave me the slip by breaking through: I must have spent about ten minutes over this little diversion and handing over my rifle—a ·355 Mauser—to the peon started along the cart-track once more; I leading. I must have covered half a mile when on turning a bend in the track I suddenly saw the tiger lying down on the shady side of the cart-track, about 40 yards off. He saw me at the same moment and was off in a bound and, by the time I grabbed hold of my rifle and turned round, all I saw of him was his hind-quarters and tail. By Jove, he was quick! and though I ran along the cart-track towards him I did not even get a further glimpse of him, as the jungle here was thick, low scrub. Following him was futile and, when a squirrel started its cry of alarm about two hundred yards further in, I knew he was nowhere near. Needless to say, I was absolutely fed up to think how easily the tiger had escaped me and cursed myself for not keeping a sharper look-out, my peon for a lazy lout for failing to tie up a buffalo somewhere in this neighbourhood the previous evening and the tiger for an arrant coward! When I got back to camp I had no appetite for breakfast and so both my boy and cook caught it also. However in the evening, when in cooler frame of mind, I consoled myself with the well-known dictum that, "everything happens for the best."

Between the above date and till I met the Conservator on the 10th of February nothing more exciting occurred than that of my bagging a four horned antelope and the little beast, though badly hit, did not drop till he had gone something like two hundred yards. I shot him with the ·355 Mauser and I then, in a way, felt glad that "Mr. Stripes" did prove such an arrant coward.

On the 18th the Conservator and I arrived at Tatilanka camp about noon, and while chatting, Mr. Barry's boy came rushing in greatly excited and informed us that a coolie had just brought a message, that a tiger had carried off a man, about half an hour ago quite close to the forest bungalow. This was too much for me so after a hasty meal I got hold of my heavy rifle, a ·471 D. B. H. V.

and four cartridges and prepared to start. Outside the bungalow there was a gathering of fully sixty Koya bamboo-felling coolies who had struck work as soon as they heard that one of their fellow-coolies had been carried off by the man-eater and in their midst was the bamboo contractor trying his best to appease them. I soon got hold of the leader and asked him what he wanted and he said that all of them would be very thankful if I found out the dead body and recovered it for them : this I promised to do at once and with that they quieted down. At last—it must have been about quarter past one—I set out with my shikari peon and the Koya, who was also felling bamboos alongside of the man who was carried off by the tiger, and told the rest to follow later on. It was extremely hot and after walking for some twenty minutes I turned round and asked the Koya how much further it was to the place ; as usual he replied—" oh very close, just near such and such a stream." From experience I knew what his " very close " meant and settled myself down for another half an hour's trudge and I was not wrong either. However, at last we reached the place where the man had been carried off, which must have been fully three miles from the bungalow towards Murmur, and the next thing was to find the body. This I set out to do immediately and for the first fifty yards or so it was very difficult indeed, as there was no trace of blood or signs of the body having been dragged. My peon was quite clever at tracking and kept on the right track by taking advantage of a bent twig or a disturbed leaf, which to an untrained eye would have passed unnoticed. It was hot and exciting work and the thick, young bamboo growth made it all the more difficult. After going about fifty yards we came across the first drop of blood and thereafter it was quite easy to follow up ; and another fifty yards further there was a pool of blood where, no doubt, the tiger had dropped the body for the first time. Soon afterwards the trail led across a small sandy stream and the peon here drew my attention to the huge pug-marks and remarked that this tiger was undoubtedly the same one we saw near Murmur lying by the side of the cart-track at 11 A.M. and I could not help agreeing with him. A fifty yards further there was a large dry stream about twenty-five feet wide and the tiger had dragged the body across this and cleared the further bank—about 3 feet high—

in one bound, not allowing the man's body to touch the ground anywhere ! we came across the body under young bamboo-growth about thirty yards from the stream, and on examination found that one thigh had been partly eaten and, no doubt the tiger was still feeding when he was disturbed on hearing us approach. I now suggested to the Koya to return and bring some more men but he did not like the idea of going back alone and so I had to send the peon with him, while I kept watch. The peon returned some fifteen minutes later with about thirty men and I asked them what they wished me to do next and like sporting fellows said in one voice that I should sit up for the tiger and assured me that the brute would turn up by six o'clock. So picking out the nearest tree I had a rough *machan* erected and swarmed up to my hard perch and started my vigil from about 3-15 P.M. after telling the rest to go away, with instructions to talk loudly as they went and they did talk loudly, too ! I really thought they would drive away any animal—man-eater or no man-eater—within a radius of two miles ! After quarter of an hour, when everything had quieted down and I was conjecturing in which direction the tiger would approach, I thought I heard the rustling of dry leaves some forty yards behind me, but I did not give it much attention thinking it was either pea- or jungle-fowl Ten minutes later there was a further rustling—much closer and more to my left this time—and I felt certain that the tiger was on the move. A few minutes later there was no doubt about it, for I made out his soft tread and deep breathing—up to now I could see nothing of the beast but I soon caught sight of him coming sneaking along. Eventually, when he was about thirty yards from the kill and about the same distance from me, he gave me an excellent standing half-broad-side shot, which I did not fail to take advantage of, and drawing a bead on to his shoulder, fired. At the shot he was thrown back on to his haunches, but in a twinkling bounded forward in a mad rush straight towards my tree and after travelling about 20 feet toppled over and started kicking about. I was taking no risks, so I let him have the second barrel in the centre of his chest and with that he stopped struggling. From the moment he was first hit to the time he gave up the ghost not a growl or a moan did he give out.

After about fifteen minutes' lusty shouting I was able to get my peon and the coolies to me and then I had to convince them for about five minutes that the tiger was quite dead before they ventured to come and help me down the tree.

My first shot was beautifully in the centre of the shoulder and would have sufficed—but who can tell? Years ago in a beat I had shot a wild boar with a " paradox " at fairly close range, right in the neck; of course, the fellow went down as if struck by lightning and I walked up to the beast, which was still struggling, and thinking he would not move again turned and went back to my shooting-stool 20 yards away and, lo behold! when I turned, to look for my pig he had disappeared!! I could not believe my eyes and I never saw that pig again, though I followed him for miles and miles.

While half the men were busy preparing a bamboo stretcher on which to carry the tiger to camp, the remainder were heaping up dry bamboos and brush-wood over the deceased Koya, for they told me that they never take the body back to their village in such cases, but burn it on the spot where it was found. Well, I did not like to interfere with their custom and allowed them to do so, after first instructing them to clear the jungle of combustible material right round the pyre, and by the time I made a move for camp the deceased Koya's remains were going up in smoke.

I reached the bungalow about 4-30 just as Mr. Barry was having tea and after his congratulations I told him the story over two much needed cups of tea. The tiger was carried in about three-quarters of an hour later and I measured him at once and give the following measurements, as they may interest:—

Length from tip of nose to tip of tail $9'\text{-}3\frac{1}{2}''$; girth of left and right fore-arms $18''$; girth behind shoulder $47''$; girth of neck $28''$; height $39''$. I had no means of weighing the tiger, but I don't think I will be far wrong if I put down his weight somewhere in the neighbourhood of 450 pounds. The tiger had enormous front paws and the pads measured $5\frac{1}{4}$ inches each way. He was in the pink of condition, beautifully marked and most powerfully built; his top right canine tooth was broken off in half and I guess this used to give him many a bad tooth-ache, which may possibly

account for his restlessness and taking to killing men. Beyond this there was no other defect traceable in him, but his clavicles were quite small and thin, and half an inch at the thinner ends of each clavicle seemed to be separate from and just joined on to the remaining portion by cartilage. In none of the other tigers shot by me were the clavicles in two parts and I think the "floating bones" of this man-eater quite out of the ordinary. I estimated the age of the tiger to be 23 years, but Messrs. Van Ingen and Van Ingen, Mysore, to whom I sent the skin and skull for mounting, write as follows:—"This animal must be about 18 years old as the teeth are very solid and the gums have receded a good deal."

Before I could start with the skinning, the Koya ladies of Tatilanka village requested me to allow them to dance around the tiger, but when they wanted me—the slayer—to stand in the middle while they danced, I absolutely refused to concede to that part of their request and told them to finish their dance by the time I had had my tub; but they were still hard at it when I came back and I had to drive them away, as there was not much time before the light failed. In fact, the rough skinning and pegging were completed only about 10 P.M., by lamp-light, and the lips, ears and pads had to be finished off the next morning.

About 8-30 P.M. after dinner, there was a good deal of weeping and on inquiry I learnt that the deceased Koya's wife and five children had arrived. The wail of the mourner was uncomfortably close to the bungalow and, as I felt like bed at about 10-30, I sent a peon to tell the widow not to cry—but I regretted the step the next minute, for the crying increased and looked as if it would keep on in that pitch till morning! So I sent for the woman and told her that there was no use of her crying any more—her man was killed and I had avenged his death by shooting the tiger! but my words were like oil to fuel and I was really in a dilemma as to how best to get rid of this noisy crowd. At last in desperation I told the woman I intended giving her and the children fifty rupees—my words acted like magic and I was able to get into bed soon afterwards and have a good sleep; but I did not dream of man-eating tigers! The villagers and bamboo

contractor were greatly pleased and relieved that I had destroyed their dreaded enemy and the latter gave all his bamboo-felling coolies a feast the next day.

This article will not be complete without the information of the number of persons killed by the man-eater and an amusing, but authentic, anecdote to give the reader an idea of the beast's daringness.

The man-eater first made his presence felt some three years ago and from my inquiries I gathered that he killed about eighteen persons, five in one village alone. The Divisional Officer, however, informed me that inquests were held only over the bodies of some six persons; but this large difference can be easily accounted for by the fact that the bodies of a good mumber of victims were not found and a number of cases of persons killed in the interior away from the police out-station were not reported. Now for the anecdote, which was also told me by the Divisional Officer. A couple of years ago the Inspector of Police was cycling along the D. P. W. road from Murmur to Kunavaram early one morning and while going along merrily he thought he heard some animal galloping behind him and turning round saw, to his horror, that it was a tiger! The Inspector was at this critical moment at the foot of a slight rise in the road and when he attempted to increase his speed the chain of his cycle snapped. Of course, there was nothing else for him to do but throw down his cycle and run as fast as he could and shin up the nearest tree and this he must have done in record time and his performance was all the more creditable, for I am told he was rather a stout man! However, he had done the tiger in the eye and he was none the worse for his experience when he was helped down by some villagers, who were attracted by his shouting, half an hour later.

R. MITCHELL, P. F. S.

EDITORIAL NOTES.

We have recently received a small booklet from Messrs. W. W. Howard Bros. & Co., London, entitled "Some prominent works recently executed in India and Burma timbers." This gives a list of various public and private buildings in which Indian,

Burmese and Andamanese timbers have recently been used. It also gives the nature of the work executed, the trade names of the woods used in each work, and the names of the contractors, or architects engaged in these works.

It is to be noted that Indian timbers have recently been used in the following public buildings; the London County Hall Westminster, the Bank of England, Finsbury Circus Branch, the Offices of the High Commissioner for India, and also in St. James' Palace, as well as in a number of large business premises and private houses. Seven Railway Companies, besides, used Indian timbers, chiefly for railway coach building. A list is also given of Indian timbers used nowadays in the British Isles, for all sorts of different miscellaneous purposes.

The Silviculturist, Forest Research Institute, Dehra Dun informs us that the teak seeds sent by Maung Po Thit, E.A.C. of Forests, which were taken from a teak plant 23″ high and 2½″ in girth in the nursery of the Burma Forest School, were sown by him in his nursery, near Dehra Dun. The seeds have all failed to germinate and have now been attacked by insects. They all appear to have been infertile. This matter was referred to in the Editorial Notes of the January 1923 number of the *Indian Forester.*

REVIEWS AND EXTRACTS.

BENGAL FOREST ADMINISTRATION REPORT FOR THE YEAR 1921-22.

During the year 2,706 acres were added to Reserve Forests.

Protected Forests were reduced by 6 square miles. This is accounted for, in the main, by two areas in the Sundarbans not being disforested in 1902 and 1903. The writer states that it is not quite clear how these areas were forgotten.

Unclassed forests remained the same as in the previous year.

The total area of State Forests at the end of the year was 10,696 square miles or 13½ per cent. of the total area of the Province.

It is good to see that it is hoped to speed up forest settlements. Where urgent works have to be taken in hand it is with difficulty that the forest officer carries on when the settlement is delayed for a long period. Often of course, this is unavoidable, but if steps are taken to avoid delays it will help matters a lot.

All the plantations in the Darjeeling Division were surveyed. This is a step in the right direction and would be good to see others following suit.

Revised working plans for 46 square miles in the Darjeeling and Kurseong Divisions, were sanctioned during the year. The plans for the Chittagong Divisions are nearing completion, and are no doubt eagerly awaited, as it states later on in the report that the sale of timber has been stopped in these Divisions pending the provisions of the new plan, which accounts for some of the shortage. The Kalimpong plan lapsed during the year, but nothing has been done yet owing to the paucity of officers. This difficulty should soon be solved as the new Imperial recruits are arriving every year. (It is noted from the *Gazette* that an officer has since been sent on working plan duty to Kalimpong)

The clear-fellings are behind hand in the Duars, and this is only to be expected, when dealing with the large areas down for felling under the artificial method. It is only possible to clear-fell an amount that can be successfully dealt with during the coming year.

Will this system continue in Bengal? It might be suggested that is only an interim period until the problem of sal regeneration is solved. It will be seen later that the present method is very costly.

Thinnings in sal are also in arrears. This is to be regretted, as sal repays the work done. It is hoped that increase of staff will enable the operation to go ahead, but it is useless to mark the trees unless the contractors are encouraged to work the areas.

146 miles of new roads and paths were constructed during the year at a total cost of Rs. 29,374. The cost of repairs was

high. but there had been much damage by floods and several roads that had not been repaired for some time, were taken in hand.

Out of a total of Rs. 61,561 spent on new buildings, Rs. 24,735 was spent on new quarters for subordinates and Rs. 22,343 on officers' bungalows at headquarters and forest rest-houses. Up to date no arrangements have been made for the housing of gazetted assistants attached to divisions. There seems to be an urgent necessity for some provision in this direction now that the Province is getting up to the full strength of the sanctioned cadre. The need is more felt when either the D.F.O or the attached officer is a married man.

The Consulting Engineer to the Government of India, who visited the most important divisions considered that roads were the best means of exploitation at present. Bengal hardly seems ready for more advanced methods. There are the usual forest offences, but less than the average of the three preceding years, though damage by fire (as in other provinces) and illicit fellings have increased. The increase of injury by fire, which is mostly in the Buxa Division, was largely due to unrest among the tea-garden coolies stirred up by political agitators. It must be also remembered that the first three months of 1922 were exceptionally dry.

We also see that $\frac{4}{5}$ths of the illicit fellings were in Chittagong and Cox's Bazar. There the political atmosphere was very heated. Several forest buildings were burnt, including the D.F.O.'s bungalow and office with all records at Cox's Bazar. The forest officers in these parts had an exceptionally trying time, and touring was not an easy matter with the non-cooperation.

Turning to the chapter on silviculture, we see that natural reproduction of the most important species is sadly lacking, otherwise there is little to note of interest beyond plantation work. It might be said here that if both the vernacular and botanical names were given when referring to trees it would make the report much more interesting to those outside the Province. We all know that vernacular names are not the

same all over India. Little has been done to induce natural reproduction. Plantations are the main feature in Bengal. *Taungyas*, where it is possible to get in the cultivators are very cheap, the only expense being the fencing, which is very heavy with the type at present used. If the proposed new split fencing is a success it will greatly cheapen the cost of plantations.

Departmental crops have been grown at a loss, but these are only put in where cultivators are not available. The cost of an acre in the plains where small areas are taken in hand runs up to Rs. 63, this includes fencing and loss on departmental crops. It must be remembered that it is useless to attempt plantations without a strong fence. The departmental crop takes the place of cultural operations and enables the plants to get away from the weeds, so the loss is not so serious as at first might be imagined. There are large regular plantations at Rajabhatkhawa in the Buxa Division. Large areas are leased to the Buxa Timber Trading Company. The amount they clear-fell each year is planted up by the forest department. Here 206 acres cost Rs. 22,319 including fencing. It was impossible to get cultivators in these plantations and this accounts in part for the high cost of formation.

The figures for the year for new plantations are :—380 acres regular plantation at a cost of Rs. 24,492, and 1,155 acres of taungya at a cost of Rs. 34,434. The total cost of creation from the outset has been Rs. 2,92,745 and upkeep to date Rs. 1,86,809. Plantations have just emerged out of the experimental stage in Bengal.

Financially the year has not been so good as last. The income is only Rs. 6·10 lakhs as compared with Rs. 8·48 lakhs the year before. The results are perhaps not satisfactory, but one must take into account the slump in trade and the political atmosphere during the year.

Two divisions ran at a loss, but the deficit in the case of Kurseong is more apparent than real, and can be explained by the large stocks of departmentally sawn timber in hand, and also by the fact that the cost of the Forest School and Silviculturist were borne by the division. It seems unfair that these two items

should be shown against any one division. Direction division seems to be the right place for them.

Bengal, though a small province from the point of view of forests, is very go-ahead, and can look forward to better years, that is, provided funds are available. If the revenue is to increase the expenditure must also increase, and this is a point which must not be lost sight of in the future.

C. T. T.

THE VALUATION OF AMERICAN TIMBER LANDS.

By K. W. Woodward.

Published by Chapman & Hall, Ltd., London.

The aim of the book is to give some idea of the timber resources of the United States and at the same time information likely to be of use to the investor, timber cruiser or student of forestry.

As a basis for his work the author divides the country into various types of forest, his type being an area with approximately the same climatic, topographic and soil conditions and hence to a large extent the same species. In most cases it is necessary to redivide his main types into various sub-types.

Practically each type occupies a chapter and he gives twenty-two main types but this includes as separate types Alaska, Porto Rico and the Philippines. In addition there are four general Chapters on Timber Valuation, Land Valuation, Titles and the Outline of a Report on a Tract of Woodland.

Each type is treated under the heads of General conditions, Timber Valuation, Land Values and Titles. He commences with a general description of his type, its climatic and topographic features, its vegetation, the dangers it is subjected to and a table of rates of growth. The rest of the chapter indicates the methods usually employed in valuation, the percentage of the area which should be done to form a sufficiently reliable estimate of values, the cost of the work, often very usefully expressed in terms of man hours or horse hours, the prices lumber is likely to fetch, the stumpage profits, an idea of the value of the land employed, etc., etc.

The book contains a great deal to interest any forester but on the other hand as it deals with types in a definite country, and as its main object is not silvicultural but actual values, it naturally is not a book which will be widely read except in the country of its origin. Even the values given are not of very great use to us in India for, as the author rightly says, they can only be broad averages and naturally vary very greatly from place to place and in any case the prices and costs given are often very different from those at present in force.

On the other hand the work is ably done and gives one an insight into the trouble taken by the American investor to value his product and it is very different from the haphazard methods of so many Indian contractors where the purchaser tells his agent to value the coupe, the agent tells his munshi, the munshi asks the forest guard who gets the information from a local coolie.

To those foresters interested, or whose work is connected with costing, this book will undoubtedly give many ideas of the usefulness of allotting their expenses carefully to the item to which it is really chargeable. A point which strikes one forcibly is that anything in the nature of a complete enumeration seems never to be done and the maximum enumerated is to be not more than 25 per cent. while 5 per cent. or less is often considered sufficient. In the tropical areas the percentage enumerated drops to $1\frac{1}{4}$ only.

It is worth noting that General volume tables cannot be applied direct as the local conception of timber is so variable. This is a problem which will be even more important in India. Volume and yield tables in India must be built on some standard idea of volume as local conversion varies often in the same division. Factors must then be found showing the relation between the standard and the local result and those applied in using standard tables.

The only portions of the book of real local interest to Indian Foresters are those which concern the forests of Porto Rico and the Philippines. There mangroves, tidal forest, moist deciduous

forest, rain forest, diptero carps, etc., occur, all of which are interesting and familiar to us.

While appreciating the value of the work from the American point of view it is not a book which will be of direct use to the ordinary forester in India.

S. H. H.

FORESTRY IN FRANCE.

La Grande Forêt de Tronçais.

(By Professor E. P. Stebbing.)

I.

The great Forest of Tronçais, perhaps one of the oldest in the Midi, is situated in the department of Allier, and is remarkable for its similarity in some aspects of the Forest of Dean in Gloucestershire. That this resemblance of the two forests is not greater at the present day is due to the fact that Tronçais has been under more or less conservative management for some 350 years or so; whilst up to comparatively recently for well over a century the Dean was the playground of amateurs, possessing little knowledge of forestry science. That a considerable part of the Dean could produce such oak as are to be seen in Tronçais admits of little doubt. And they would be standing there now were our race animated by the spirit which breathes in the following allusion to Tronçais. "Cette forêt, gloire incomparable de notre France, doit être conservé, telle que les siècles nous l'ont léguèe; et nous devons â notre tour, la léguer à nos déscendants intacte, plus belle même s'il se peut. Les forestiers décideront dans quelle mesure at par quels moyens la chose est réalisable."

During the Napoleonic Wars and at Trafalgar many of the British ships were built of oak from the Dean, whilst the timbers of many of those in the French Navy came from Tronçais. A century later during the Great War, Tronçais was again called on to provide first-class oak timber of magnificent size and length for French naval requirements. Owing to the fault management of the past, the Dean contained no such timber,

Abundant evidence exists that Tronçais, from very early times formed an important centre of development, for tumuli and other traces of the Celtic races can be seen. The forest was of strategic importance to the Romans in their struggles with the northern tribes, and they established several important towns linked up with a road system; Roman remains are still to be found. With the weakening of the Roman Empire the tribe of Bituriges obtained the upper hand. By the 10th century the "cite' biturige" had disappeared, and the region known as the *Pagus Burbunensis*, became the first home of the Seigneurs, subsequently styled Dukes, of Bourbon. The forest proved of great importance alike to the Roman legionaries and the barbarian tribes, both as a stronghold and, with the development of trade, as a source of wine casks (which it still produces), which replaced the leather bottles of the Romans. It also provided the fuel required for the iron industry which Cæsar established amongst the Bituriges, and the pannage required for the feeding of swine which was so important in those days. Many parallels to this history are to be found in the Forest of Dean. With the increase of allotments for cultivation on the boundaries of the forest the owners had the right, or used it, to collect fuel and litter in the forest, and to graze their animals therein. In the 13th century the ownership of the forest was assumed by the Dukes of Bourbon, and the area was maintained for hunting purposes, much as the Norman Kings created the Dean, Windsor Forest, and so forth for a similar purpose. The area of the forest had by now considerably decreased. The old forest had stretched unbroken between the two rivers, Cher and Allier. In the 7th century the disciples of St. Columba began to found monasteries in the neighbourhood of Tronçais, and these foundations and priories so increased in number as to make considerable inroads on to the forest area The occupants also made use of the forest in a most wasteful fashion. The same contraction of the forest took place in the Dean—in both regions we find many place-names ending in "wood" or "forest" which are now far without the existing forests. The respective areas of Tronçais and the Dean are 27,250 and 15,000 acres. The Bourbons were attainted in 1527

and ownership of Tronçais was then assumed by the State, under whom it has since remained.

The forest, and especially the outer areas, went through various vicissitudes, and were badly treated up to the middle of the 17th century. It was the rise to power of Colbert, the great Minister of Louis XIV, which saved Tronçais and other forests in France from the inevitable ruin and disappearance which threatened them. The far-sighted Colbert originated a forest policy for France, a policy which has had remarkable after-results. He appointed a Commission in 1670 to examine the state of Tronçais Forest, the boundaries of which had recently been laid down on the ground, many of these old pillars still existing. The Commission, in reporting on the forest, pointed out the great damage under which it was suffering from bad and illicit fellings, loppings, grazing, fires and encroachments. They discovered extensive heather-covered blanks, with scattered old oaks, 300 years and more in age, standing on a destroyed forest soil. The scheduled areas at this period were as follows :—(1) 675 acres of well-grown young oak high forest; (2) 3,275 acres of old open high oak forest, destitute of young growth beneath ; (3) 23,310 acres exploited in old fellings and ruined ; with heather-covered areas containing scattered old oaks and much browsed patches of young ones.

It is difficult, almost impossible, when examining Tronçais to-day, to realise that the above description was ever applicable to the present forest.

The working plan drawn up in 1670 for the amelioration of the forest prescribed a conservative annual cut of 62½ acres amongst the remaining old oak to provide for naval requirements and a planting scheme for restocking the destroyed areas at the rate of 250 hectares (750 acres) a year, reserving, where possible, 10 old stems per hectare. This plan aimed at a rotation of 200 years for the oak. Its prescriptions were carried out with great care during the following 110 years (1779), and the forest was to a great extent restored. The magnificent stands of old oak seen to-day in the blocks known as La Plantonnée, Morat, La Pelloterie, and elsewhere are the results of the work put in hand by the 1670 Commission,

They average 108 trees to the hectare, at least ⅔ oak and ⅓ or less beech, with an understory of beech. Average diameters of oak—Breast high, 30 inch.; mid. diam. 24 inch. Average height of bole, 64 feet; of tree, 100 feet. Average vol. of bole equals 200 cubic feet, and of crown 14 cubic feet. The oak dating from this period have provided the chief timber of fine size cut in Tronçais during the past 85 years. And the areas from which it has been cut were described in 1670 as barren or in very poor condition, thus indicating what continued scientific conservative management can do.

It is of interest to note that even before the Colbert Commission started work at Tronçais, John Evelyn, in England, was preaching his planting campaign, and had published the first edition of his *Sylva*. The Dean profited by that campaign during the succeeding two centuries, after which the management of the forest went to pieces.

But Tronçais was also to experience vicissitudes. During the last third of the 18th century there was a great development of the iron industry, and the forges established in connection with the Berry mineral deposits used enormous amounts of wood; having exhausted the Berry forests, they demanded wood from Tronçais. A road was opened out through the forest connecting the two rivers, the Cher on the west and the Allier to the east. By a decree of the Council of State in 1779 the working plan was modified, and the east and west section of the forest were placed under a rotation of 45 years, with an annual cut of 157½ acres in each section. Fortunately the central portion of the forest, comprising 8,538 acres, was created a reserve, the rotation being maintained at 200 years. It is due to this foresight that Tronçais at the present day possesses the magnificent oak alluded to above. Between 1779 and 1788 iron works were opened out within the forest, and concessions of forest were granted to the owner. He was granted a 40 year lease on an area of 6,390 acres, with permission to clear (cut) one-fortieth of the area per year. The mineral was transported from the forest by pack mules, and permission was accorded to graze these animals in the blank areas provided these were sown up with acorns during the last 10 years

of the lease, a clause which was not fulfilled. The mules, which were very numerous, grazed unchecked in the forest as well as in the blank areas.

By 1804 it had become evident that all was not well with Tronçais forest, and careful examination was made of the whole area. Its condition in all, save the reserved part, was deplorable. It was pointed out that the measures instituted under the orders of Colbert in 1670, had resulted in the production of magnificent crops of high oak forests of great value.

The steps taken in 1779 had resulted in the destruction of the forest in the eastern and western parts. The rotation was too short for oak, and the annual felling areas more than twice as large as they should have been.—[*The Scotsman.*]

TRACTORS *vs.* HORSES IN THE WOODS.

By George A. Mackie.

[Figures available from recent Operations favour Mechanical Log Haulers.]

Woods operations for the season of 1922-23 have served to demonstrate on quite an extensive scale, the important part which tractors may be depended upon to play in the solution of the winter log-hauling problem in the Canadian woods. Hitherto there has been a tendency on the part of lumbermen to accept with a trifle more than the proverbial grain of salt the claims made by tractor enthusiasts as to the performances of these machines. These doubts have been fostered and strengthened by past experiences in the woods with tractors of various kinds which, while of real value in the work for which they were designed, had no real place in woods operations. The difficulty in the past seems to have been in securing the requisite traction power without having, at the same time, to accept a prohibitive weight in the tractor itself.

During several seasons past, the problem of hauling out the cut of logs to the main stream or nearest railway has been becoming increasingly difficult. Horse haulage was slow and

expensive and the total haul by such a method was not, in many cases, commensurate with the investment in the operation. Woods foreman were confronted with the eternal question of getting their logs out at a price which would show a balance on the credit side for the season's work

Information obtained by the writer from the men in charge of a number of tractor operations in the Canadian woods for the season just ending, would seem to indicate that the problem of economical log-hauling has been solved by them. As a further assurance of this it has recently come to our attention that one of Canada's most reliable and conservative woods experts has become a convert to tractor haulage. After investigating the possibilities and performances of tractors in recent woods operations he has revised his method of calculating merchantable timber by increasing his distances from the railway or main streams from his former limit of five miles to a distance of from 8 to 10 miles as the length of haul which serves to best demonstrate the economy and efficiency of tractor operation but there are records available of distances both less and greater than these, in which satisfactory results have been obtained.

In one particular operation which was visited by the writer that of Messrs. Murray and Omanique near Madawaska, Ontario, a Linn logging tractor was hauling a total of 320 hemlock logs of from 16 to 24 ft. in length on seven sleighs and the tractor itself over a distance of about 4 miles with remarkable ease and all desired speed. The road was in no sense an easy one but included many steep hills—which were sanded—and several short curves. This particular tractor was making seven round trips in 24 hours—4 by day and 3 at night and was averaging well over 2,000 logs per 24 hours day on this operation.

Some interesting figures as to operating costs of tractors in woods operations are furnished in a letter from T. S. Woollings & Company, Limited, Englehart, Ont. According to the data compiled by this operating company, the Linn logging hauler tractor supplied by Messrs. Mussens Ltd., Philips Place Building, Montreal, proved a substantial saver of both time and money over previous results obtained by horse haulage.

Mr. Woollings states that the tractor hauled a total of 7,000 cords of wood a distance of 6 miles between the 7th day of January 1923 and the 10th day of March 1923, at a total operating cost of $ 2,050 including gasoline, oil, and 2 men's time operating the tractor. This, as Mr. Woollings points out, brings the actual hauling cost to 30 4-10 cents per cord. Comparing this figure with the previous haulage costs, when horses were used, which worked out at from $ 1·50 to $ 1·60 per cord, the difference is quite notable.

Based on these figures the actual saving in money on the operation above described reached very substantial figures. The saving per cord between $ 1-50 per cord and 30 4-10 cents per cord on the total haulage of 7,000 cords works out to the very handsome sum of about $ 8,400. Or put in another way, the tractor method of haulage shows a saving of about 80 per cent. when compared with horse haulage.

The facts and figures above presented are surely significant and worthy of the consideration of all those to whom the problem of the log-haul has become a vexed question.—[*Illustrated Canadian Forestry Magazine, April 1923*].

RANDOM NOTES ON LOGGING IN INDIA.

By J. Lees Harrison.

I have been out in India over a year now and am carrying on the good work and defacing the country side. Coorg is my sphere of operations. No doubt when I mention Coorg you are as wise as you were before. As a matter of fact, it is a small province some 2,500 square miles in extent in the south of India and lying west of Madras Province. It lies really in the Western Ghats. It might hardly be said to be much in the public eye but it is a case of "guid gear in wee bulk."

When I first arrived in this country at Bombay and reported my arrival there, advising that I was posted for duty to Coorg, the "powers that be" accepted my statement with resignation but expressed doubts as to the exact whereabouts of my destination. It was known to be down south somewhere, but no one was sure

how to get there, I tackled the invaluable Cooks, however, and after a close scrutiny of maps, guide books, time tables, etc., they ran Coorg to earth. The nearest railway station is in Mysore, nearly 60 miles away. However when I did arrive in Coorg, I found it was well worth searching for. It is a hill province some 2,000 to 3,000 ft. up, and consequently the climate is normally delightfully cool compared to the plains. From October to April, the weather is excellent. The monsoon begins in May or June and then the purchase of an umbrella is a sound investment. The umbrella is opened up then and is not taken down again until the end of September. Incidentally our rain-gauges are specially made for us to enable us to measure the rainfall correctly; a normal gauge would register for about half a day and then overflow. Last July for three consecutive days the rainfall was eight inches, eleven inches and nine inches. That is a fact. At the end of last wet season I was quite relieved to find that my feet were not webbed.

Forest exploitation work here is going ahead well. That may sound rather bombastic as regards myself, but what I really mean to convey is that this branch of the forest work is well supported by those in high places. Coorg is rich in timber and her timber resources have been nibbled at so far. I should say, for her size she is one of the richest provinces in timber in India.

There are really two main timber areas as regards schemes for extraction—one in the south-east and the other in the south-west. The eastern forests are not being worked to anything like their full extent at present, but that is only a matter of time, and at present we are finding our feet. The extraction of logs is being carried out at present by means of ordinary bullock and buffalo carts, each cart taking one log. The timber found there has a good market value, the principal species including such timbers as teak (of a good quality) and rosewood; (both species you are acquainted with). C. S. Martin has worked out a scheme on a commercial basis for extraction on a large scale, and that we hope, will be put in operation in the near future.

Exploitation work going forward.—Exploitation is going on at present in the Western Ghat forests and there I am endeavouring to justify my existence. The area to be tapped there is some 65,000 acres in extent. The timber lands lie in

the valley of the Barrapole River and in the valleys adjacent to it. Except in parts along the slopes adjacent to the main river itself, the timber has never been touched, and there is a splendid stand. We hope to be able to extract some 40 tons per acre (incidentally a ton is on an average, 50 cubic feet). At least 15 tons per acre will be what is known as first-class species. Most of these species are little known outside India so far, but we are fairly certain that it will be only a question of time before they have a name in the world market. Our first-class species include *Artocarpus hirsuta (ainee), Dipterocarpus indicus (kalpaini), Dysoxylum malabaricum* (white cedar), *Hardwickia pinnata (chonapaini), Calophyllum tomentosum (poon), Hopea parviflora (iripu).* These species are all fairly heavy (average 50 cubic feet to the ton). The lumber produced is ideal, practically free from knots and with few flaws. For the most part, the trees have long, straight stems and make ideal logs as regards handling. Only logs over 18″ in diameter are extracted ; the average diameter is about 2′-6″. As regards length, we extract the logs in 18 to 35 feet lengths.

The names of the species I have given may convey nothing much at present, but I give them to you so that when they become well known in the timber world, you will have been well informed for some time back.

As regards the forest policy, these forests, as are the majority in India, are State owned, and consequently the question of regeneration is carefully studied. It has been reckoned that to produce a mature tree in these regions some 60—100 years are necessary. The suggested scheme is to log over some 650 acres per annum and thus, even taking the longer period of 100 years before the trees have grown again, by the end of a century extraction can be started at the first area to have been cleared. It sounds very fine, and as the first forest engineer in Coorg I would seem to head a chain of forest engineers who will go on for all time. The operation here may be said to be of the Tennyson Brook order, and may go on for ever, irrespective of the coming and going of forest engineers.

Logging Railways employed.—As regards the works, some 13 miles of two-foot gauge forest railway has been laid up the main valley, and the work is practically completed now. The nature of

the country is such that little can be done as regards branch lines and spurs, and to transport the timber from the surrounding slopes to the tramway, other means of communications will have to be used. The country around is very hilly and the slopes are steep.

The felling heretofore has been done with axes alone. This last year, with what one might term varying success, I have been endeavouring to get the coolies accustomed to the use of the saw. Where I am handicapped is that the first inhabitant in this country never seems to have used a saw and, therefore, the trouble is that the methods as practised by their forbears weigh very heavily with them, and I am deeply thankful that their great great-grandfathers did not cut down trees with a pocket knife or wait until they blew over, otherwise it would be even harder to have the trees felled at all. I used to think at first that their attitude was due to laziness, but I realise now that it is really diseased conservatism.

Patiently I have pointed out how much quicker and easier it is to fell trees with a saw. The coolies' attitude seems to be that the sahib has some mad scheme in his head, probably due to a touch of sun, but that they had better try to humour him and help him in his folly. The usual result of two men with a saw is an "S" cut in the tree. Naturally this tends to bind the saw from the very start. When the saw has gone in some little way and finally binds, they stop with a relieved air and philosophically await further orders. One might almost say there was an air of "I told you so" about their attitude. The cause of the trouble is pointed out and they are shown that a straight cut must be made. What seems to be a dawning intelligence in their faces makes hope show her head once more. Then to set to work with vigor (eastern vigor) and make a cut even more wavy than before, and the saw binds after about four pulls. (Need I say I am following with much interest the development of types of power saws for trees felling.)

One great problem as regards here is going to be the transport of the logs from the stump to the tramway. So far we have been employing elephants and teams of buffalos, but for long hauls that method is rather too slow and costly.

Experimenting with Pole Tramways.—I am laying stretches of pole tramway of one to two miles, but I have not got the system in operation yet. The trucks will run on two 6-inch to 8-inch diameter poles, and to prevent the poles from spreading there will be cross poles or sleepers every 10 ft. or more. The present stretch of track is laid more or less on a down grade all the way, with a maximum grade of about 1 in 30. The present idea is to haul a set of two trucks either by buffalos or by an elephant. The disadvantage of such an arrangement is that the load is limited to one set of trucks, and also there is difficulty as regards braking. A buffalo's normal pace is gentlemanly two miles per hour. Like the coolies, however, they are very conservative, and although well behaved enough when hitched in to a cart or hauling a log, the idea of hauling trucks on a pole tramway does not appeal to them. On their first few efforts in that line they endeavour, more or less successfully, to pull the trucks off the line. An elephant is much better for this sort of work if he can be spared, but to teach an elephant to pull the trucks on the pole tramway one requires the patience and knowledge of an animal trainer with years of experience. When the elephant is first hooked on to the truck he is deeply suspicious. When the "mahout" persuades him to pull and the truck begins to move, he moves also, and in top gear. Yes, he moves, and although an elephant is not built on the lines of a greyhound, he can certainly cover the ground through the jungle. The elephant will sometimes go off through the jungle, taking with him as much of the truck as can manage to hold together. When an elephant is thoroughly frightened there is not stopping him quickly. Cussing an elephant is not much good; he has rather a thick skin, a brain the size of an orange, and no finer feelings that I have noticed, so what is the use? I have heard a fluent logger giving an impassioned address to a refractory "donkey" merely to relieve his feelings, but I was not long enough in the States to pass out in logging elocution, and in any case cussing is very hot work out here.

Hopes for the Tractor.—I have been trying to get details of any tractor of sorts which could operate successfully on the pole tramway. It is not as if the pole tramway were the main means

of transport, it being subsidiary, although important enough in itself. What I should like to do would be to able to bring down two or three sets of trucks at a time with adequate braking and be able to take them up a slight grade, if necessary. The sort of machine I thought might do was one after the nature of a Fordson tractor fitted either with spool wheels or wheels similar to those fitted on the trucks at present. I take it, the trouble would be to get sufficient friction for the driving wheels to grip on the rough poles, unless the poles were specially prepared, and at the same time prevent the track from spreading. I do not know if any of the companies on your side have had any experience with traction of this nature, but I should be very grateful for advice or for details of any good results obtained with pole tramway traction. I don't wish anything elaborate or expensive, as I do not want to spend much on laying the pole tramway track.

A Holt 10 ton logger caterpillar has been ordered and I hope to get delivery of it by the end of April. That, I hope, will do away with a lot of our transport trouble.

As regards hauling of logs over short distances and handling of logs, elephants are in a class by themselves. A good elephant will move a log of from two to three tons on the level or downhill. The trouble in using elephants is that they cannot haul uphill, and on a long haul they are not economical, in my opinion. What I hope to do in future is to use them on 100 to 200 yards haul in the jungle making jackpots to be cleared by the tractor or other means of transport. A good elephant manœuvring a log is a spectacle one never grows weary of. He will pull, push with head or foot or use his trunk or tusks in handling a log, and when a log is jamming he is extraordinarily clever at understanding where and how to apply his strength. The spectacle of the elephants working with the logs would interest Charles Murphy, of the Weed Lumber Co., greatly, I know. During my very pleasant stay at the camp near Weed, Cal., he designed a bummer to be used with an elephant. I still have that sketch. It is certainly rather too vague to be used as a working drawing, but in any case I have refrained from making use of it from a fear that he may have already patented it under the title of

the "Murphy Mastodon Bummer." Elephants differ in their methods. We use both departmental elephants and also hire Malabar elephants. Our elephants when actually pulling use chains, but the Malabar elephants haul the logs by means of a thick rope which they hold in their teeth.

On the two-foot gauge railway I have only one locomotive at present, and that is a seven ton machine. A ten ton locomotive is on order and should be along any day now.

The floating of the logs is rather a problem. Not only is the stream bed rather rocky in places, but the nature of the logs does not assist the solving of the problem. Many of the first class species do not float, and other agencies have to be used to buoy them up. Before I had thought of taking up forest engineering I used to be greatly interested by the accounts of Stewart Edward White and like authors how the progress down stream of a "logger rampant, on a log flottant, with a peavy couchant." During our trip in the States I had an opportunity in Idaho, along with another of our fellows, of walking on logs. Walking would hardly describe it, as the performance consisted of diving off and coming up to breathe now and again. This was not what we had intended to do, but that represented the nett result of our labours. Onlookers appreciative of our efforts assured us afterwards, when they had regained their powers of speech, that our aquatic display would assure us of a hearty welcome at Los Angeles. I may say that was the worst log pond I had ever tasted, and I can truthfully state that I never drank anything worse all the time I was in the States. To resume the question of floating, owing to the bad state of the river and the lack of buoyance of 50 per cent. of the logs, many of the rafts have to consist of single logs. These are buoyed up by bamboos and reeds on either side. Lower down the river, rafts can be assembled of from 10 to 20 logs, which greatly facilitate transport.—[*The Timberman, June 1923.*]

CORRESPONDENCE.

THE FOREST RESEARCH INSTITUTE, DEHRA DUN.

SIR,—I have been much interested in reading Mr. Dalley's articles on the work of the Forest Research Institute at Dehra Dun. There are, however, several points which appear to me to call for some comment.

Mr. Dalley gives a great deal of useful information on the subject of the organisation and work of the Forest Products Laboratory at Madison, U. S. A., and mentions the close co-operation which exists between it and the commercial lumber world of America. Now such co-operation would be impossible were the American, perhaps the hardest business man in the world, not assured that he had something to gain from the Laboratory and its work. It is obvious that the scientist must be working in such a way that the results of his experiments are applicable to the needs and necessities of commercial life. Here it is that I think that if the Forest Research Institute at Dehra Dun would adopt a similar theory in principle and practice, they would similarly bring themselves into closer connection with industrial and commercial activities.

Mr. Dalley evidently realises this because he says: "To produce facts of value to the commercial world, research will have to be conducted on a commercial basis as far as possible......... some idea of working costs and working conditions on a commercial basis must be obtained if any real progress is to be made. Nothing will advertise the forest products better than the fact that the Forest Department can actually demonstrate commercial methods and processes, and can give reliable information as to the financial results that are likely to accrue from any particular undertaking."

It may be of interest to point out some of those efforts which *have* been made and to the experiments which have already been conducted with so much success in the United Kingdom. This work was started in 1914 but the volume has greatly increased since 1919. I think that some such short summary as the

following, of what has already been done, is not inapplicable. The following timbers have been successfully and continuously seasoned artificially since 1919. The wood at that time was to be used for Exhibition purposes, but since 1920 it has been prepared for general commercial use.

Acacia leucophloea
Adenanthera pavonina
Adina cordifolia
Albizzia Lebbek
A. odoratissima
A. procera
Amoora Wallichii
Anogeissus acuminata
Artocarpus integrifolia
Balanocarpus utilis
Berrya Ammonilla
Bridelia retusa
Bursera serrata
Canarium spp.
Carallia integerrima
Carapa moluccensis
Careya arborea
Cedrela Toona, etc.
Chickrassia tabularis
Dalbergia cultrata
D. latifolia
D. Oliveri
D. Sissoo
Diospyros Kurzii
Dipterocarpus tuberculatus
D. turbinatus
Dysoxylum binectariferum
D. malabaricum
Eriolæna Candollei
Fagræa fragrans
Gardenia latifolia
G. turgida
Gmelina arborea
Heterophragma adenophyllum
Homalium tomentosum
Lagerstrœmia Flos-Reginæ
L. hypoleuca
L. lanceolata
L. parviflora
L. tomentosa
Melanorrhœa usitata
Michelia Champaca
Millettia pendula
Morus lævigata
Parashorea stellata
Pentace burmanica
Planchonia andamanica
Pterocarpus dalbergioides
P. macrocarpus
Schima Wallichii
Schleichera trijuga
Taxus baccata
Terminalia bialata
T. Chebula
T. Manii
T. myriocarpa
T. paniculata
T. tomentosa
Vitex glabrata
Xylia dolabriformis

In seasoning these timbers no limitations of thickness have been observed; timber had been dried even up to 10″ thickness

in fact, to whatever thickness has been called for. Fresh imported logs have been sawn, seasoned, and the finished work fixed and in position where required within three months or less.

Thousands of tons have been successfully treated; including all kinds of British-grown hardwoods and those from other countries, such as oak, ash, mahogany and walnut, the value of finished work in artificially seasoned timbers has amounted to over one million pounds sterling. Notwithstanding the stringent examination of all this work practically no complaints have been made and there has been no loss whatever.

I am entirely in agreement with Mr. Dalley's proposal that the Forest Department should "actually demonstrate commercial methods and processes," but I cannot see what advantage there can be in experimenting or demonstrating with a process which differs in any respect from one which is commercially practicable. Those whom the scientist would wish to interest would surely say: "I cannot use the elaborate process which you have established and what I want to be assured is that I can get the good results of which you speak with an ordinary practical working kiln such as I *can* afford to pay for and work."

Even if this objection were not raised, there has now been abundant evidence that all that is required for seasoning Indian timbers can be achieved with an ordinary commercial kiln, such as, as I have already said, has been working successfully in London since 1919. After the prolonged experience which I have now had I am only able to come to the conclusion that experimental dryers which differ in any way from the ordinary commercial type, are both extravagant and unnecessary.

The value of this work is added to rather than detracted from by the fact that it has not always proceeded without mistakes. Very considerable difficulty, for instance, has been experienced on more than one occasion, especially in drying 3″, 4″ and 5″ thicknesses in *kokko* (*Albizzia Lebbek*); in Andaman *padauk* (*Pterocarpus dalbergioides*) which was 9″ or 10″ thick, and also in dealing with several of the *Terminalia spp*. Records of this work and the results of various tests have all been kept and form most valuable data on the subject.

Then the author says that "the public is, on the whole, ignorant of the kinds, qualities and the prices of available Indian timbers and the localities where these timbers can best be obtained." This may be true as regards knowledge in India and Burma, but certainly since the European Agency has been established the timber world here, and indeed the public in general, is by no means ignorant of the "kinds, qualities, etc., of available Indian timbers." Lectures have been given, pamphlets have been published, articles by the score have been contributed both to the technical and to the general press on the subject of Indian timbers and their utilisation in Europe, while specimens of these timbers have been sent broadcast; indeed, no stone has been left unturned to make their merits recognised. The wonderful success which has been achieved for these woods, which are to be found to-day in many of the most important buildings in London and the provinces, would not have been possible had it not been for the extensive publicity campaign which has been organised.

This limiting of the application of Mr. Dalley's remarks to India and Burma *alone* should again be borne in mind when he asserts that "unless the Forest Department is better equipped and better staffed, the commercial development of the forest products of India will not be possible." I regret that I cannot agree with such a statement as this, for no one can deny that the forest products of India *have* been developed commercially in the last few years on a scale which has amazed even the most enthusiastic. Of course, were the Forest Department better staffed and better equipped, such development might have been more rapid and more satisfactory.

There still remains, it is true, a wide field for still further development, but a very valuable foundation has been laid in this country and cognisance might well be taken of it.

ALEXANDER L. HOWARD.

RED COLOURING OF LEAVES.

SIR,—In the article "Œcology of Indian Savannah Plants," appearing in the July number of the *Indian Forester* Mr. Sher Singh states (on page 365)—

> "Now, the best way to exclude heat rays or red rays is to let the light filter through a layer of red colouring, which, according to the laws of optics, absorbs complementary blue rays, and lets the injurious red heat-rays pass out. It might be argued that although red rays have come out on the other side of the plant, they have passed through the leaf and have, therefore, heated the leaf in their passage. This is not true, because, light to be effective, must be absorbed. Thus although the sun's rays pass through air, the atmosphere is not heated except by conduction or convection."

The general conclusion he arrives at, namely, that leaves turn red to minimise the amount of heat absorbed, may be true but the explanation quoted above is entirely incorrect. One of the preliminary facts in optics is that all sense of colour is due to the reflection of the colour-ray seen, and the absorption of the other rays of the spectrum by the object under observation. To make it a little clearer, we see a lamp blacked surface to be *black* in sun-light, because it absorbs all the colours and reflects none—for black signifies the absence of colour. Similarly, a red leaf is seen to be red because it reflects only the red rays and absorbs the rest.

It is, therefore, both unnecessary and incorrect for Mr. Sher Singh to state that a red leaf lets the red heat rays pass *through* a leaf without affecting it, for the simple explanation given above suffices to show that a red leaf absorbs no red or heat rays, not by allowing them to pass through, but by reflecting them. His explanation is also unjustifiable for a leaf being opaque, cannot be compared to the atmosphere, as in the case he instances, of the sun's rays passing through the atmosphere without heating it.

B. A. CARIAPA, P.F.S.

LUMBERING AND WOOD WORKING INDUSTRIES IN THE U. S. A. AND CANADA.

Misstatement corrected by the author.

SIR,—My attention has recently been drawn to a remark in the above book which is misleading as it stands and likely to prejudice Canadian Manufacturers of Sawmill Machinery.

The remark is contained in Volume II, Chapter 6, page 116, dealing with Sawmills and reads as follows :—

> "A good deal of American machinery finds its way into Canada, but Canadian mill machinery does not go into the States."

In making the above statement I was under the impression that it was correct, the reason given me being that Canadian manufacturers could not compete in the States with American manufacturers owing to heavy import duty imposed by the American Government. Even though such trade is seriously handicapped by the duty in question I have recently learnt that at least one well known Canadian firm is doing considerable business with its machinery in the States. I desire, therefore, to express my deep regret to the Firm in question and any others similarly situated for the remarks above quoted.

F. A. LEETE, I.F.S.

DOMESTIC OCCURRENCES.

Birth.

MUIR—At Saugor, C. P., on 24th August 1923 to Mr. and Mrs. Wm. Angus Muir, a daughter.

Death.

MUIR—At Saugor, C. P., on 27th August 1923 of Pancreatitis, Clara wife of Mr. Wm. Angus Muir, I.F.S.

Photo-Mech. Dept., Thomason College, Roorkee.

Assistant Conservators of Forests joining the Indian Forest Service in 1923.

VOLUME XLIX NUMBER 11

INDIAN FORESTER

NOVEMBER, 1923.

STATE CONTROL OF PRIVATE FORESTS.

Judging from the standards of progressive European countries it is estimated that forests extending over about 18 per cent. of total area will be required to satisfy the timber requirements of India when economic conditions become intensive as in the European countries. Whereas India has only 10 per cent. of her total area classified as permanent or Reserved State Forest at present. Hence it is necessary that some sort of control must be exercised over vast private forests, to check wasteful exploitation of the country's natural resources, in the interests of national welfare. Various measures have been tried in different countries to secure sound management of private forests on the principle of sustained yield, when required by national safety or national economy, at the same time interfering least with the individual's rights. Sometimes these measures take the form of mere encouragement and providing of technical supervision and sometimes of actual control, even prescription of a Working Plan.

In France the tendency at the time of the Revolution was towards nationalisation of forests, but in the reaction that followed a strong individualistic movement set in, and private forestry has always played an important part, since then. The State now only adopts measures to encourage sound management of private forests and does not interfere with the proprietor's rights. The most important legal enactment concerning private forests is Art. 219 of Code Forestière passed on June 18th, 1859, which lays down that no private owner can clear-fell his forest without notifying the fact to the sous-prefecture at least 4 months in

advance. This refers only to the ordinary forests, a very strict law, of course, exists as regards "protection forests."

The Swiss Forest Law of 11th October 1902 lays down in Art. 26 that private forests may be arranged in groups for management under the State officials, and the State also contributes 5 to 25 per cent. of the emoluments of forest officers appointed to look after private forests. But the most important measure is that which lays down that the total afforested area must not be diminished. Thus a sound hold is maintained over the management of all private forests.

The Forestry Act of 1919 gives powers to the British Forestry Commission under Clause 3 (*d*) to undertake the management or supervision of woods belonging to private persons or corporations; otherwise there is no direct interference with private forests in Great Britain except in the case of settled estates whose present holders are not allowed to utilise more than their proper share of timber.—[Schlich.]

In Prussia where the State owns about 50 per cent. of forest no control over private and communal forests is deemed necessary, but in other German States control, in some form or other, is exercised over private forests.

In Austria and Hungary where the State owns 16 per cent. and 7 per cent. of forests respectively some sort of control is considered necessary; whereas in Russia where the State owned 66·4 per cent. of forests before the Bolshevik régime, and did not have the means of even managing them properly, no control was exercised over private forests.

In Spain "which has perhaps suffered more from the effects of forest destruction than any other country" (Dr. Fernow), the State owns only 4·5 per cent. of forests and so has to exercise a control over 80 per cent. of communal and private forest.

All these considerations lead to the conclusion that some sort of State supervision is considered necessary in all cases where the State does not own forests adequate to the needs of the country even in countries where the national aspect of forestry is fully well realised and where forest conservancy has been practised for centuries as a national art. What form that supervision must

take depends upon the needs of the country, the degree of civilisation, the national traits, attitude of the people towards forests and above all on the degree of recognition by the people of obligations carried with forest ownership But in all cases it is the duty of the State to enforce stringent protective measures whenever the interests of the cummunity are in danger of being sacrificed to satisfy the whims of capricious owners. In India the story of private forestry is a gloomy chapter in the history of forest conservancy, vast areas of forests belonging to the Zamindars and landowners containing very valuable species and of great potential value to the nation, have been subjected to indiscriminate fellings with consequent impoverishment, merely to swell the immediate profits.

In order to introduce sound management on the principle of sustained yield in these forests the Indian Forest Department has now and then acquired private forests on a system of *lease.* This system has worked admirably well without any friction, and it is impossible to think of a system of State control showing greater respect for the individual's rights. In fact, a wiser step in relation to private forests, in danger of destruction, cannot be placed to the credit of any forest administration in the world.

Some time ago the valuable teak forests belonging to the Zamindar of Ahiri in the district of Chanda were thus brought under the control of the Forest Department of Central Provinces. The Zamindari is situated in the southern portion of the Chanda district with Ahiri as its headquarters—a distance of 60 miles by road from Ballarshah, the terminus of Wardha Ballarshah section of G. I. P. Railway, and 70 miles from Chanda, the headquarters of the district. The estate was originally a feudal grant made about 6 centuries ago by one of the Gond Rajas of Chanda, to an ancestor of the present Zamindar. The Zamindar paid a small tribute in recognition of the sovereign authority, but otherwise he exercised supreme control in the days of the Gond Rajas, and it was only after the district came under the British in the year 1853 that his legal position in respect of proprietorship was questioned, and his title thereto admitted only conditionally, *i.e.*, subject to the conditions of succession, loyalty and good adminis-

tration. In 1893 the estate descended to the present Zamindar but owing to bad administration was placed under the Court of Wards in 1902 and still continues to be under it.

The forests leased contain in places teak superior to Allapill teak which is supposed to be the best teak in Central Provinces, but unfortunately it has suffered considerably in the past from shifting cultivation, fire and extravagant fellings, and what remains now is mostly unsound. Reckless shifting cultivation was practised till 20 years ago and still needs supervision. Compared with the adjoining Government reserved forests which have been under scientific management for about half a century these forests bring home to even a casual observer the advantages of managing forests on sound lines.

The following summary represents the conditions of lease which was affected on 21st May, 1920 :—

(1) *Area.*—Lease covers 3 blocks, Chandra, Jimalgutta and Korepalli.

(2) *Period.*—Ordinarily for 50 years expiring in 1970, unless the Court of Wards having relinquished its management of the estate, the Zamindar gives 6 months' notice of termination of the lease.

(3) *Revenue.*—All revenue from forests produce, grazing, etc., will be realisable by the lessee.

(4) *Rent.*—100 per cent. net grazing revenue, 90 per cent. of remaining surplus revenue.

(5) *Expenditure.*—Maximum fixed at Rs. 12,000 annually. It will consist of—

(*i*) $\frac{1}{6}$ pay of Divisional Forest Officer, South Chanda, and his office establishment ;

(*ii*) $\frac{1}{6}$ pay of Ahiri Leased Range staff.

(6) *Audit.*—Balance-sheet to be supplied to lessor annually by lessee.

(7) *Legal status of forests.*—Lessor agrees to have such provisions of the Indian Forest Act (*vii* of 1878) applied to the Leased Range as lessee may desire.

Villages aggregating 883 acres of the block come under the lease.

The above conditions of lease are imperfect in more than one way, but the greatest drawback is probably not transferring the villages enclosed in the leased blocks to the Forest Department, owing to which much difficulty is experienced in getting labour for forest works. Another drawback is perhaps the fixation of a maximum limit for expenditure, as this will seriously tell on the total net revenue. It will be necessary to spend large sums on cultural operations for a long time, if it is desired to improve the growing stock, in addition to expenditure on the utilisation works.

Although the manifest result of scientific management will be mostly confined to an improvement of the growing stock, the financial results achieved are much better than anticipated at the time of the preparation of the Working Plan in 1917—before the forests came under the control of the Forest Department.

It will no doubt take a long time to undo the harm that has been done to these forests under the old régime by people, who have the curious mentality of regarding forests as inexhaustible sources of revenue, but now that the forests are put under the proper treatment their capital value is bound to increase with a corresponding increase in the annual revenue in due course of time.

S. A. VAHID, I.F.S.

THE STUDY OF A PRIMITIVE COUNTRY AND ITS PEOPLE.—BEING A SHORT ACCOUNT OF THE PAWRAS AND BHILS OF THE AKRANI PARGANA, WEST KHANDESH DISTRICT, BOMBAY PRESIDENCY.

Preface.—This short account of the Pawras and Bhils of the Akrani pargana owes its origin to the fact that as Divisional Forest Officer of North Khandesh Forest Division and *ex-officio* Assistant Collector, Akrani, exercising II class magisterial powers, the writer frequently had to decide disputes and pass judgments on domestic and general legal questions in the Akrani pargana.

Up to the present no survey settlement has been introduced in Akrani owing to the peculiar circumstances of the country,

but in 1915, at the request of Mr. E. G. Turner, I.C.S., Collector of the district, the writer drew up a scheme for introducing a simple form of settlement in this hilly chess-board of cultivated fields and woodlands: This matter is still in abeyance. As no settlement has been completed and introduced questions of ownership and transfer of land, etc., have to be decided by custom, and it was with the hope that an account of some of the customs of the Pawras and Bhils of Akrani might be of use to his successors and of interest to others that the writer asked Messrs. B. J. Joshi and L. V. Gonsalves, who were for $6\frac{1}{2}$ and $2\frac{1}{4}$ years, respectively, Range Forest Officers and *ex-officio* Mahalkaries of Akrani, and also the Rev. A. P. Franklin, for many years a Missionary in Akrani, kindly to supply him with the notes on which much of this account is based. The writer's sincere thanks are due to them for their cordial response to his request.

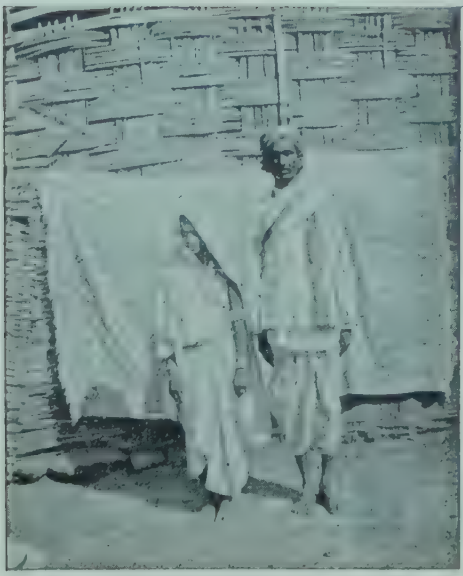
The scope of this monograph has been somewhat amplified at the suggestion of a friend who thought that a more general account of these hill forest peoples would prove of interest to readers of the *Indian Forester.*

This account will supplement and in certain respects correct the information about Akrani given in the *Gazetteer* of West Khandesh district which has not been revised for many years.

The writer himself held charge of the office of Divisional Forest Officer, North Khandesh, and was *ex-officio* Assistant Collector of Akrani exercising II class magisterial powers from 7th May 1913 till 20th June 1919 during which time the notes above referred to were prepared, but pressure of work has prevented earlier collation and publication.

Country.—Akrani pargana, sometimes spoken of as "Dhadgaon Mahal" after the name of its chief village, comprises about 382 sq. miles of which 304 sq. miles are reserved forest. It is all very hilly and is situated to the north of Shahada and Taloda Talukas, West Khandesh district. The western portion comprises two more or less parallel ranges of the Satpura hills which enclose an irregular table land and merge into an intricate network of high hills on the east culminating in the large flat topped hill called "Toranmal." The northern range drops

1. A batch of forest fire watchers, in Akrani.

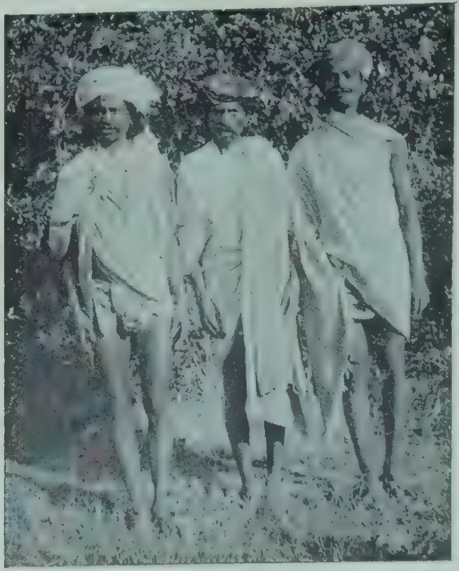


2. Pawra headman of an Akrani village and his wife.

5. A typic l Bhil woman of Akrani, and her children

Photo by Rev: A.P. Franklin.

3. Headmen of four villages, situated on the banks of the Nerbudda.



4. The headman of Toranmal village and his two shikaris. All are Naikada Bhils.

Photos by Forest Ranger L.V. Gonsalves.

steeply into the river Nerbadda on the north, and the southern range rises sharply from the Tapti valley plain on the south.

The pargana is entered from the Tapti valley plain by bridle paths through two main passes, *viz.*, the Chanseli pass and the Dara-Mandvi pass. There are at present no cart roads leading up to Akrani, but one was surveyed years ago and subsequently abandoned. The road has now been re-aligned and is designed to connect Shahada in the Tapti plain with Dhadgaon in Akrani, going up *viâ* Dara and Mandvi. Construction work on this project was begun at the Dhadgaon end as a famine work in 1919 and has since been spasmodically continued. During the last 10 years or so a few bullock carts have been introduced by the Missionaries residing at Mundalwad, Akrani and by a few others, but their use is at present very restricted owing to lack of cart tracks. Provisions are carried to and from the plains on pack animals or on headloads along bridle paths which are annually improved and repaired by the Forest Department.

Dhadgaon with the adjoining village of Roshmal is situated in the middle of the most fertile portion of this populated table-land and is the centre of the official life and trade of the pargana. Here is found the old fort containing the Range Forest Office which is also the Mahalkari's *kacheri*. It must have witnessed many stirring scenes in the disturbed times of old. But now all is peace except for the noise from the beloved country liquor shop on high days and holidays, for the Bhil loves his tot! Outside the fort are the Government Rest House, Range Forest Officer's bungalow, and quarters for the other Forest, Police, Revenue, Excise and Medical Officials, etc. and last, but by no means least, must be mentioned the Government *Mhowa* spirit distillery, which will again be referred to in another paragraph.

Climate.—The temperature varies from occasional light frosts in the pleasant but somewhat feverish cold season to about 105° F. in the hot season. Thus the heat is less trying than that of the Tapti valley plain in the hot season; and Toranmal, though very difficult of approach, except through Barwani State on the east, is a delightful haven of rest for the jaded official who can

enjoy peaceful nature in the grandeur of solitude. Toranmal is a fairly well wooded plateau, about 16 sq. miles in area, surrounded by steep scarps, and takes its name from the *toran* bush *(Ziziphus rugosa)* whose fruits are much sought after in famine years, but its chief source of delight is the large artificial lake measuring some 1½ miles round, on the side of which the Forest Rest House is built. The Hill is fortified with double walls of considerable strength but they have now fallen into ruins in many places. Numerous finely carved stones are found scattered about indicating the former presence of some fine Hindu temples, but very little seems to be known of the history of this delightful fortified hill-top beyond the fact that the Mahabharat mentions Yuvanashva, the ruler of Toranmal, as fighting with the Pandavs, and tradition says that while Sita was resting in a neighbouring ravine Ravana came and carried her off to Ceylon while Rama, her husband, with his brother Laxman were out hunting. Toranmal is also said to have been the seat of the rulers of Mandu.

As the plateau has an average elevation of some 3,500 ft. and the shade temperature never exceeds 85° F., I believe proposals have been made from time to time to make a sanatorium here for the neighbouring districts, but it has been condemned on account of the mists which are said to enshroud the hill during the monsoon months. These mists cannot be very bad, however, as the rainfall of the district is so low, and at Toranmal probably does not exceed 30 to 35 inches. It is believed that the real inner reason for neglect in developing this delightful spot is its inaccessibility. It is too far from roads and railways to become a first class hill station but a little co-operation with and from Barwani State might make it possible to take a road up from the plains along which local people could climb in their modest "Fords."

Forests.—The hills are covered with deciduous forest comprising teak (*Tectona grandis*), *sadada* (*Terminalia tomentosa*) *dhaura* (*Anogeissus latifolia*), *khair* (*Acacia Catechu*), *mohi* (*Odina Wodier*), *salai* (*Boswellia serrata*), *gorad or kinai* (*Albizzia procera*), *sisham* (*Dalbergia latifolia*), *tiwas* (*Ougeinia dalbergioides*), *biya*

(Pterocarpus Marsupium), *aola (Phyllanthus Emblica)*, *charoli (Buchanania latifolia)*, *mhowa (Bassia latifolia)*, *mango (Mangifera indica)*, bamboo *(Dendrocalamus strictus)*, *etc.*, *karvi (Strobilanthes callosus)* is also very common on the higher hills and tall grass everywhere abounds. As the rainfall is low, the dry season long, and the forests are frequently overrun by severe fires, the stocking is thin and the trees are generally small except in ravines. Formerly very exaggerated ideas prevailed as to the excellence and density of the Akrani forests. Fine trees do exist here and there, but extraction is difficult. When the road from the plains, which is now under construction, is completed, the extraction and export to the plains of some of the better teak and *tiwas* will be a paying proposition. The main purpose of the road is for purposes of administration, however. Until a railway is constructed north of the Tapti, and a larger market stimulated, there will be little scope for extraction of forest produce in large quantities from the more inaccessible hills of Akrani.

Although the forests are extensive, forming part of one of the largest continuous forest tracts in India, and practically no people live in the eastern hills, game cannot be considered plentiful. It is said that wild elephants abounded in the hills up to the 17th century. Tiger, panther, bison, sambhur and black bear are found in small numbers, while wild pig, barking deer and four-horned antelope are fairly common. The great heat and lack of drinking water in the long hot weather is probably responsible for the lack of big game. In places peacock and jungle-cock abound.

The Khandesh Bhil is one of the best *shikaries* the writer has ever met, but the Pawra is not of much use in this respect. It is wonderful to watch a Bhil pick up the track of an animal on parched ground. It is a great joy to a Bhil to accompany an officer on a shooting expedition, and when the officer is gone he keeps his eye in by many an illicit hunt with his friends armed with bows and arrows and an old muzzle-loading gun or two. Nothing comes amiss to him from a hare, which he kills with a well-aimed axe, to a doe sambhur!

Population.—Most of the people live in the western portion of Akrani which forms an undulating table-land surrounded by higher hills and comprises a chess-board of more or less cultivated land and woodland surrounded by reserved forest on the higher bordering hills.

At the census of 1921 the population of Akrani, which chiefly comprises Pawras and Bhils, was 12,982 (6,813 males and 6,169 females) compared with 12,506 in 1911. Roughly speaking, we may say that half are Pawras and half are Bhils. These reside in some 130 villages of which those to the West of the Chanseli-Dhadgaon bridle path are mostly inhabited by Bhils while those to the East are mostly inhabited by Pawras except in the extreme East and North-East. The Pawras are particularly numerous around Dhadgaon where the land is most fertile.

The term Bhil is said by Wilson to be derived from *billee*, the Dravidian word for a bow, which is the characteristic weapon of the tribe, whereas Sanskrit lexicographers derive it from the root *bhil* meaning fallen or degraded. The references to Bhils in Sanskrit literature show that the Bhils were both hated and feared and were gradually pushed back by the invading Aryans. The Bhils are supposed to be the " Pygmies " of Ctesias (400 B.C.) and the " Poulindai " and " Phyllitae " of Ptolemy (A.D. 150).*

The wild woodman of the Satpuras is dark, lean but well made, active and hardy with cheek bones, wide nostrils and in some cases almost African features. There are, however, considerable variations, some being almost sharp in features. This must be due to intermarriage, possibly with Rajputs, in former unsettled times. Despite their lean appearance they have great powers of endurance and will, on occasion, walk uphill and down dale 50 miles in a day. It is interesting to note that they are so used to walking single file amongst the hills that when they make occasional expeditions to the large bazars in the plains they continue to walk in single file.

Bhils are fond of spirits, improvident and thriftless, and loathe steady work, but at the same time they are simple, chatty, hospitable, faithful and honest, and have some sense of humour.

* Tribes and Castes of Bombay—*Enthoven.*

Their loathing of steady work is so great that they will scarcely stay on famine works in times of scarcity, and departmental road and building works can only be completed with difficulty by exercising strong moral pressure and relieving the labourers every 15 days. Their simplicity is such that the wily trader of the plains always gets the better of them when they sell their spare grain and jungle produce. On the whole they are but indifferent cultivators, and their houses, which are grouped together, are inferior structures of wattle and daub with thatched roofs.

The Pawras as a class have better features and are lighter in complexion and more refined than the Bhils, and are said by some to be of Rajput origin (*vide Gazetteer* of West Khandesh district, page 95). They are excellent cultivators and are very thrifty. Their houses are frequently not grouped together but placed each in man's own field and are very neat, being made of carefully woven bamboo walls with thatched or even tiled roofs. They generally have two gables, one-half of the building being occupied by the family and the other half by the cattle.

The dress, ornaments, habits and language of Pawras and Bhils differ somewhat. As regards ornaments Bhil women wear heavy brass leg bangles, which may reach from the ankle almost up to the knee, and necklaces of many rows of cowrie shells. Such ornaments are never worn by Pawra women; they generally wear silver ornaments such as anklets, bangles above the elbow and necklets. There is a tendency nowadays, however, for the wealthier Bhil women to follow the Pawra fashion in wearing silver ornaments. These ornaments are all made at Dhadgaon

The Pawra considers himself to be of superior caste to the Bhil and will not eat food or drink water from the latter's hands, although he will drink country spirit from a cup which a Bhil has put to his mouth. A Bhil, however, will take food from a Pawra.

Enthoven, in his Castes and Tribes of Bombay, says "that the so-called Bhil tribes are merely clans or families, differentiated according to the extent to which they have adopted Hindu customs, inter-married with other races, or are affected by local nfluence. Why this natural process of differentiation should be

accelerated by the Bhils themselves is difficult to explain, unless the influence of the caste system be taken into account—a system which was undoubtedly quite unknown to the original Bhil." This statement is somewhat interesting for the Rev. A. P. Franklin of Mundalwad, Akrani, says that prior to the survey of 1903—06 both Pawras and Bhils used to eat with the Christian Missionaries and Christian converts, but that at that time some 30 Brahman Surveyors tutored them in the duties of caste, since when Pawras and Bhils no longer eat with Christians.

Both among Pawras and Bhils of Akrani there are certain sub-divisions known as *kools*, *i.e.*, clans or sub-caste. These *kools* take their names after the names of the villages inhabited, and the members of one clan frequently consider themselves superior to those of another. Theoretically a member of a higher *kool* is not supposed to eat from the hand of a member of a lower *kool*, but nowadays this is not strictly followed. Mr. D. R. S. Bourke, I.F.S., who is acquainted with Akrani, traces these *kools* to the old tribal system under which the people were divided up in tribes, each under a definite hereditary chief, who was often known as *naik*. Most of these *naiks* were suppressed by Outram with his Bhil corps, which was raised in 1825, when the Bhils were giving much trouble by raiding the villages of the plains. In this way the Bhil tribal system was broken up for reasons of public security, much as the Scotch clan system was broken up in the 18th century after the rebellions of 1715 and 1745.

The few Bhils who inhabit the Toranmal plateau differ from the ordinary Akrani Bhils, and are known as Naikada Bhils. They are hardier than the Pawras or the ordinary Akrani Bhils and speak a different dialect. They appear to be the remnants of a clan which formerly gained its livelihood by *kumri* or shifting cultivation in the eastern hills.

Bhils in general have been described as lawless, but the Akrani Bhil is not addicted to dacoity like the plains Bhil. The Pawras and Bhils of Akrani are all ignorant cultivators, and are for the most part truthful, law abiding, and mild, though they have very short and hasty tempers. Thus, though theft is almost unknown in Akrani, murders which are committed in the heat of a

quarrel, are unfortunately somewhat numerous; the three principal causes of murder being (*i*) animosity on account of one man taking another's fields, (*ii*) the faithlessness of a wife, or (*iii*) a quarrel under intoxication, which is their worst vice. After committing a murder the murderer is frequently found to have hanged himself on the branch of a tree near-by. In other cases he gives himself up to the custody of Government authorities, making a clear statement of confession. Rarely he hides himself in the forest for a short time but eventually gives himself up to justice.

The consumption of *mhowa* spirit plays an important part in all social functions, whether to celebrate a birth, death, marriage or religious festival, and result in crime and general deterioration of the race. Judging from liquor sales the people must spend much more on liquor than on clothes, and hence the poorest, who *will* drink, suffer greatly in winter for lack of a blanket which few seem to possess.

The liquor problem is a difficult one in Akrani as the illicit distillation of *mhowa* spirit in the hills is so easy, but the present policy of Government is to maintain an outstill at Dhadgaon for the preparation of a specially coloured liquor which is sold in the hills only at cheap rates so that illicit distillation is scarcely worth while. Nevertheless illicit distillation still goes on to a certain extent, for home prepared liquor is regarded as essential in the performance of certain ceremonies. The extent of the vice may be estimated to a certain degree from the fact that in 1916 the average land revenue for the whole of Akrani was Rs. 3,000 while the contractor of the outstill paid an annual license fee of Rs 12,500 and succeeded in making a handsome profit.

Mhowa flowers are not used entirely for the production of liquor but are frequently dried and smoked with locallygrown tobacco. The dried flowers are also ground up and mixed with *bajri* flour to make a sweet form of *bhakar* (bread cakes). *Mhowa* seeds (*tolambi*) are also pressed cold and yield an inferior edible oil into which *bhakar* is sometimes dipped before being eaten.

The Pawras and Bhils of Akrani are more luxurious living than the Bhils of the plains in that practically everyone provides

himself with a cot to sleep on. But while enjoining restful sleep he frequently denies himself the luxury of a bath for perhaps a week at a time !

The people start cultivation in the middle of June when the monsoon breaks, and finish harvesting their crops in February or March. The next two months, *viz.*, April and May, are known as the *pauna* or visiting months and during this season the people spend their time visiting each other all over Akrani. When entertaining his visitors a Pawra or Bhil must provide adequate supplies of liquor and food to his guests unless he wishes to be looked down upon by the rest of the community.

In a footnote on page 85 of the *Gazetteer* it is stated that Bhils will never eat monkey-flesh. This is not confirmed by local Missionaries nor by what the writer has heard.

At the conclusion of the war the then Mahalkari—Mr. L. V. Gonsalves, who takes great interest in the wild tribes—invited several of the more adventurous Pawras to accompany him to see the peace celebration at Bombay. A good number at first wanted to go, but the number eventually dwindled down to three owing to their fear of being drafted into the labour corps of war time, of which they had heard most absurd rumours. After donning the irksome but regular Hindu-dress in place of their free and easy loin-cloths they ventured down from the hills and eventually reached the railway. This was a source of amazement, but it was as nothing compared with their impression of the sea when they reached Bombay. They were taken to various places of interest including the museum where they at first thought the stuffed animals were alive, but their greatest wonder was when they saw the long lines of fine buildings in the Fort. These they compared with their beloved hills and asserted that such buildings could not have been raised by man but must be the works of God Would that we could mete out the same praise on all the buildings in Bombay !

Language.—As regards language it is stated on page 84 of the *Gazetteer* that in Khandesh the Bhil dialect is a mixture of Hindustani and Marathi with Gujarati endings, and that Akrani Pawras and western Bhils speak among themselves a dialect of

Gujarati unintelligible to the plain's Bhil. Again, it is stated by some that there was an original Bhili language, but it seems more probable that the Bhils speak a dialect in accordance with the proximity of the larger languages. Certainly those who live in the west understand Gujarati more or less. However this may be, it may be said there are three dialects in Akrani, *viz.*, Akrani-Bhili, Pawri and Naiki-Bhili spoken in the eastern hills. It seems strange that Bhils and Pawras who live in the same village continue to speak their own separate dialects even when talking to one another.

[*To be continued.*]

H. W. STARTE, I.F.S.

FIELD CROPS IN TAUNGYA PLANTATIONS.

Introduction.—The object of this paper is to put forward reasons to show the necessity of studying the field crops grown in our *taungya* plantations. This means of regenerating the forest has now assumed an important position in Burma, and on its success will depend the future of very large areas of our most valuable forests. But hitherto whilst the Forest Officer has selected the species of tree to be grown and ordered the manner of growing it, the selection of the field crop has been left entirely to the *taungya* cultivator and no regulation has been attempted. Now the interest of Forest Officer and *taungya* cultivator are not identical. With the former the establishment of a successful plantation of trees is the vital object, whilst he wishes the *taungya* cultivator to make a comfortable livelihood both to ensure good work and because he likes to see those assisting him flourish. The *taungya* cultivator, on the other hand, is primarily interested in obtaining a good field crop on which his bread and butter depends and his interest in the tree crop must naturally remain subservient to this. Like all agriculturists he is intensely conservative in his methods. To obtain the best results with the plantations these two points of view must be reconciled, which means compromise. If the Forest Officer does not effect this compromise, no one else

will, and it is hard to see how he can effect it when his ignorance of field crops leaves him with a one-sided knowledge

Need to study field crops.—The broad objects of the *taungya* plantation method are to (*i*) clear the ground, (*ii*) introduce the tree crop and (*iii*) keep down weeds, all at the minimum cost. The *taungya* cutter clears and burns the area and does a good proportion of the weeding in the normal course of cultivating his crop. His extra work lies in the dibbling of seed or seedlings and the more thorough weeding demanded, for which he frequently obtains a monetary reward in addition to other concessions, provided he hands over a successful plantation. But a great deal of the suppression of weeds must be dependent on the field crop covering the ground, and since there are few field crops which will not overtop tree seedlings, at any rate the more valuable species, during their first rains, a certain amount of shading with consequent loss of growth has to be faced. Here is an obvious subject for study to attain the objects of the *taungya* plantation with the least sacrifice of growth of the seedlings. At the end of their first year seedlings spaced 6′ × 6′ will very seldom cover the ground sufficiently to prevent a strong weed growth, and although in some cases the second year's growth may rapidly shade the ground too much to permit of further cultivation of field crops, in other cases the area remains sufficiently open. In the latter case the cultivation of a second year's field crop will not only reduce weeding expenses but afford the additional advantage of working the soil between the lines. In the case of the first year's growth of the seedlings having been retarded (*e.g.*, by defoliation), or of failure, a second year's cultivation of field crops is even more obviously advantageous. Now this second year's cultivation may mean a change of crop, the soil being unable to produce an equally exacting crop in the second year, or it may involve the cultivation of a crop which matures early before the tree canopy starts to close up. These considerations demand a knowledge of field crops and especially in the case of introducing the second year's cropping to a new division. It will very likely be said that the broad cast sowing of other species between the staked lines will effect the same objects as the second

year's cropping, but if the subsidiary species can be sown a year later there is wider choice without risk of their overtopping the main species, and wider spacing of the latter may be facilitated. Nor are we yet certain of obtaining a complete crop of subsidiary species.

Examples.—In the present state of our knowledge it is not possible to do more than cite a few examples of the effects of different field crops, not necessarily those universally cultivated. Paddy does not cause appreciable shade until the middle of the rains, but from then onwards to December a good crop causes dense shade. Although many species put on a considerable growth during the cold weather, the seedling which has suffered this suppression remains behind its more fortunate fellows. With vigorous teak the difference may disappear in the second rains, but with slower growing species or a failure of early sowing the result will be reflected in subsequent weeding expenses. Indian corn is a crop which is reaped fairly early and lends itself to spacing calculated to modify the degree of shade. Cotton can be spaced so as to afford valuable shade during the first hot weather. Tapioca (*kalawpinan*), planted after the rains have well set in, demands the ground be kept very clean and does not shade the seedlings until the rains are failing, when it gives useful protection from the hot October sun. Being a root crop its harvesting in the cold weather causes the soil between the lines of seedlings to be thoroughly worked and finely divided. Sugarcane being mounded up enables the tree seedlings to be raised out of a too wet soil.

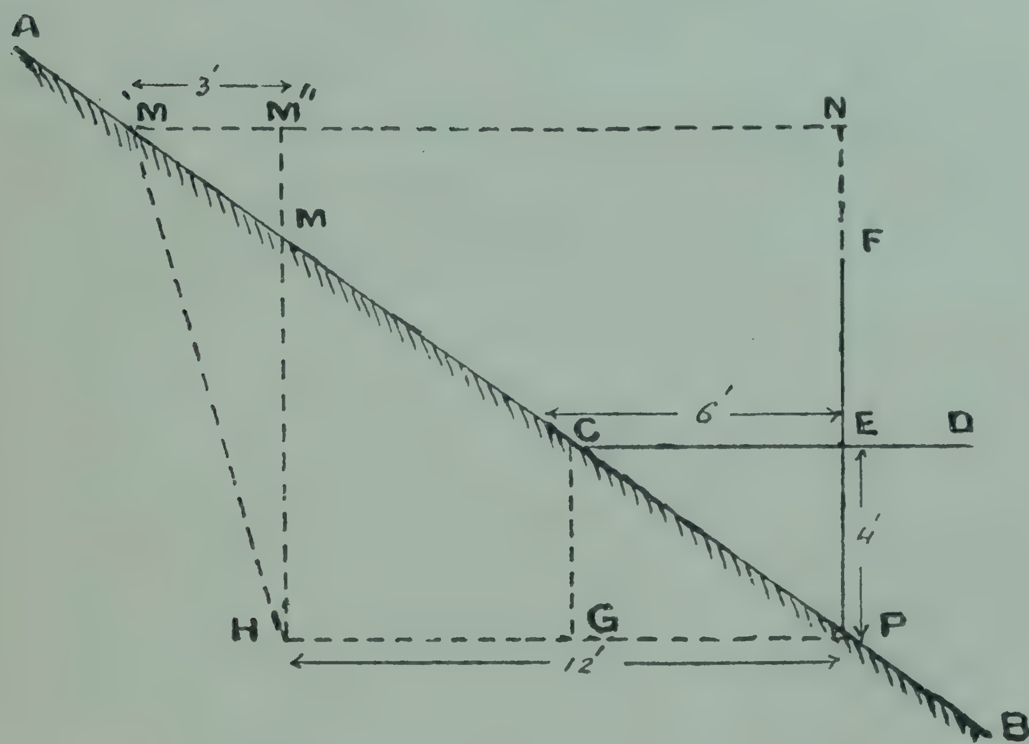
Lines of study.—The points requiring study in field crops are the suitability of different crops to various soils and their possibilities for a second year's cropping of the *taungya*. The time of planting and reaping with the period during and degree to which they shade the seedlings are points of great importance. Control of the density or spacing of the field crops may yield important results, and although this tends to reduce the *taungya* cultivator's profit within limits, suitable compensation is possible. The degree to which it is possible and profitable to thus control the field crops is a matter for investigation with a view to ascertaining the most

advantageous compromise. Side issues which will possibly be solved during any such investigations are the extension of *taungya* to soils at present uncroppable on this system and the improvement of the *taungya* cultivator's profit by the introduction of improved species or more suitable crops. The writer is well aware that there is still a large amount of investigation into regeneration of tree species required but feels that the study of the field crops in our *taungya* plantations is by no means irrelevant and cannot longer be neglected. To mention one possibility only, a suitable field crop may go far to solve the difficulty of raising *kanyin* (*Dipterocarpus alatus*) in *taungyas*. Although the Forest Officer has proved himself in the past to be as nearly a complete Jack o' all Trades as exists, it is fair comment to say that a study of field crops is outside his scope. But this is surely a case for an agricultural expert to work in collaboration with the Forest Officer.

This paper is a plea for action, and does not pretend to do more than indicate some of the more important directions in which further information is required. The writer's hope is that it may lead to discussion, ending in a fruitful investigation.

J. B. MERCER ADAM, I.F.S.

A PRACTICAL METHOD OF MEASURING EARTHWORK ON HILL-SIDES AS ADOPTED IN THE MAGWE FOREST DIVISION, BURMA.



A. B. = Hill-side.

P. = Peg along road alignment on hill-side.

C. D. = Horizontal graded rod into feet and decimals of a foot.

P. F. = Vertical. do. do.

M. H. = Height of cutting on hill-side.

H. P. = Width of road or cutting.

G. C. = Mean height of cutting.

If H. P. width of road be 12′ let vertical rod P. F. cut horizontal rod C. D. at 6′. Then read the height of P. E., *i.e.*, G. C. at E. on the vertical rod where the horizontal rod cuts it, in order to get horizontal rod C. D truly horizontal, a small rectangular spirit level can be placed on the rod and held with the hand that holds the rod. One man can use both the rod by holding a rod in each hand.

G. C. × H. P. = sectional area of M. H. P.

If the face of cuttings is to be sloped back as in M'H it is best to draw up a table to show how far M′ is to slope back from M., *i.e.*, to show M′M″.

The following table is used in the Magwe Division :—

Height of cutting.	Sloped back.
Under 3′	*Nil.*
3′—6′	1′
6′—8′	2′
8′—10′	3′
10′—13′	4′

Thus if P. E. reads 4′ H. M. will be 8′. According to the above table 8′ cutting requires 3′ sloped back, So M′M″ = 3′

$$\therefore M'N. = 3+12 = 15$$

Put horizontal rod C. D. so as to be cut by vertical rod P. F. at $\frac{15}{2}$ or 7·5′ and proceed in the manner as explained above for upright cutting.

If the hill-side is too steep mean heights for fractions ($\frac{1}{2}$ or $\frac{1}{3}$) of the width of the road can be found and add up together to get mean height for the whole width of the road.

HATIM TAI, P.F.S.

[We have submitted the above article to a Forest Officer who has studied such questions, and he makes the following remarks and criticisms.—HON. ED.]

"The mathematics of the method are correct and it is a convenient way of roughly estimating earthwork on moderate slopes. Trouble will be experienced when the side-slope of the ground is very low, when the length of the horizontal rod will be very long and also when the side-slope of the ground is very steep, when the height, at which this rod has to be held will be inordinately great.

The method of avoiding these difficulties, as explained in the last paragraph, involves a good deal of trouble and does not altogether solve the question, and I think that the method should be confined to side-slopes, which are neither too flat nor too steep.

There is one other point as regards the tables :—

" Height of Cutting "—" Slope-back. "

The figures given in this table cannot be used with all types of soil and the figures given correspond to back-slopes of 68 deg : 12′ to 80 deg : 33′. These are much too steep for ordinary soil and one usually reckons on 45 deg : as being the average back-slope."

TWO ROGUE ELEPHANTS.

In the month of December 1922 when the rice crop was just beginning to ripen I was on tour in the Goalpara Forests in Assam, which extend for a distance of some 10 to 15 miles southwards all along the Bhutan boundary. The land along the south edge of the tree forest is all under rice cultivation and liable to severe damage from wild animals from the forests, and in particular from elephants.

Elephants generally move down southwards during the rains and many of them remain within easy reach of the cultivated land until after the rice crop is reaped. Apart from herds which may vary from five or six animals to twenty or over and which move over considerable distances, and retreat to the hills in the hot weather, there are always a number of solitary males who do not seem to migrate to the hills, but who live in fairly well defined beats in grass or evergreen forest on low ground or along rivers all along the south edge of the forest throughout the year. These may have been driven out of the herds, or may of their own accord have adopted a solitary and usually bad tempered existence, and it is these who usually do the greatest damage to crops.

Many of them are well known to the villagers and appear year after year to take heavy toll of the ripening rice.

Villagers erect look-out huts between the edge of the forest and the fields, sometimes built in trees or on high poles, and sometimes on mounds of earth with a substantial ditch round them on which most of the men of the village sleep at nights armed with such firearms and spears as they possess and with a plentiful supply of bundles of dry reeds for torches and flares. The firearms are usually of a most primitive type, old muzzle loading guns, with barrels often worn to almost the thinness of paper, and bound to the stock with plaited cane. From such guns from which one would almost hesitate to fire a blank charge they will fire a charge of buckshot, or a heavy home made lead slug, without apparent ill effect.

Villagers living and cultivating land within the boundary of Reserved Forest where game protection is enforced as far as possible have usually only been allowed to possess guns, the barrels of which were cut down to about 18 inches, merely as game-scarers to prevent their use for illegal game poaching, but in view of the damage done by the solitary males it has been necessary to allow villagers to own some long barrelled guns also.

A number of the more well known of these solitary male elephants have been proclaimed as rogues, to be shot at sight, but the villagers weapons are inadquate for the purpose and as the place is very inaccessible for sportsmen armed with heavier guns (and even then it would mean a considerable amount of arrangement and by no means a certainty of success), it is not often that a chance occurs of killing one of the rogues.

These from experience learn that they have little to fear, and raid the fields night after night.

The villagers join together and advance on the intruder shouting in a body with guns, spears and flares and generally manage to drive him off into the forest for an hour or two but when things are quiet again, he comes back and the performance is repeated. Some of them do not always allow themselves to be driven off without protest and some of them will not go till the line of villagers and flares comes almost up to them, and even sometimes charge and rout the villagers, very occasionally killing

a man. These elephants sometimes also discover that among the houses in a village there are rice granaries and will deliberately go to a village and smash houses down. Possibly the discovery is made by the elephant in the first instance wandering up to the village and pulling a house down out of sheer mischief, they are wantonly mischievous, and any hut left unprotected in the forest will most certainly sooner or later be pulled to pieces by elephants. They are most destructive to boundary pillars and bridge hand rails which they seem unable to resist the temptation to pull up. Or damage to villages may be started in a fit of *musth*, when the elephant is ready to go for anything he sees, in a most reckless way.

Last December I had many complaints from one village that a well known rogue *makna* (tuskless male) was visiting their crops every night, and even in the day, and that they could do nothing with him as he refused to be driven off, and charged them if they attempted to do so. He had been seen in the fields by a subordinate Forest Officer riding home on a bicycle who left his bicycle in the forest and walked round another three miles, and he had held up a train load of timber on its way from the forest on the 2′ light railway.

I told the villagers to let me know next time he was out in their crops and accordingly about two days later they came one afternoon to say the elephant was out in crops close to railway and in full view. I sent off a couple of tame pad elephants to wait some distance from where he was, and went up on a trolley with my wife, the wife of my Conservator T., and S. my assistant who came with a ·500 Express in support of my ·475 H. V. double barrelled rifle. My wife and Mrs. T. got on to the pad elephant from which they could see him standing in the rice at the edge, of some tall grass while S. and I. went on foot along the line to where we could see him, and then turned off towards him through some low grass. He took no notice of us, and allowed us to approach to the edge of the grass about 35 yards from him across an intervening rice field.

He was standing broadside on, and as he then seemed inclined to move I fired hitting him in the head, he reeled round turning broadside on in the reverse direction, and a second shot in the head knocked him over not to rise again.

He had a small pair of tushes damaged and discoloured, and shewed obvious signs of *musth*, which probably accounted for his aggressive mood. He was a magnificent animal, his forefoot measured 5′ 1½″ in circumference and he taped, measured as accurately as possible between pegs at the shoulder, 10′ 3″.

Three days later after dusk my mahouts reported that another rogue, a tusker, was in their crops and had very recently smashed in a house and killed a man. The previous night he had come to my baggage elephants and gone to attack a tame tusker, but had been driven off.

T. and I went out on foot through the rice fields to one of the look-out huts on the ground where we found a number of men with flares. They told us the elephant had just moved off into the jungle. Scouts were sent round the fields but could not see him, so we returned to dinner. Before we had finished, the men came back and said he was out again, right in the middle of the fields. Back we went, with a company of flares and walked through the rice. I confess I did not at all like it, mine being the only rifle with the party and a standing rice crop being an impossible thing to run in if occasion arose, while on a dark night flares only showed things at all clearly about 25 yards away and very indistinctly beyond.

We saw a big thing just recognisable as something lighter than the surrounding darkness, but I could not be sure which end was head and which tail so did not risk a shot. The elephant then moved away, squeaking occasionally a very high pitched note, and we followed cautiously for about 150 yards. Then again he stopped and I saw the same indistinct light mass, but felt sure now which end of it his head must be. Still it was not clear enough to take a definite aim and the rifle sights were almost indistinguishable. But it was to be now or never as a short distance more would have taken him into heavy grass jungle and so I fired, aiming as well as I could judge, high up the back behind the shoulder.

He went off into the jungle where for about a quarter of an hour we heard him breaking grass and small trees and squeaking as before.

As it would have been madness to follow him up, we had to leave him, but I knew that either I must have missed him clean in which case he was probably no more frightened of my gun than of villagers' guns which he must often have heard, or he was very badly hit and unable to go, had he been lightly hit only he would have gone straight off for miles.

Next morning my mahouts brought me word he was almost in the same place, so T. and I went out on a staunch pad elephant to investigate. We were followed at a distance by a crowd of villagers, and by a servant who was wildly anxious to come and who carried my 12-bore with lethal bullet for his own edification, though it would not have been of much use in case of trouble.

We found the elephant some 10 yards inside grass jungle. We were in a projecting patch of grass with a large ant-heap in front and as we were in it my servant pushed on in front by the ant-heap, which was some 25 yards from the edge of the jungle where the elephant was, across a piece of cultivated land. I could only see the top of the elephant's head and fired at what I judged must be his ear hole for a brain shot. He then turned out and charged across the open. My servant after trying for a moment to get behind the ant-heap wisely fled; I tried one frontal shot off my elephant (a *makna*) which stood well but not absolutely steady. This failed to stop the elephant and as I had only one cartridge left in the rifle I thought we had better retreat, which we did. My shot however turned him into the edge of the grass, where he stood giving me a steady side shot which dropped him. He was not such a big elephant as the former, but was a fine beast for all that, his forefoot measured 4′ 9½″ round and height at the shoulder between pegs 9′ 9″. His tusks were not long but weighed 56 lbs. the pair, and it is not often one has the luck to get two rogues of this size within four days.

G. N. SIMEON, I.F.S.

EDITORIAL NOTES.

With reference to the letter from Sir William Schlich, which appeared in the *Indian Forester* of last August, under the heading

"Sir William Schlich's Services," we have received a copy of Chapter XXI, Vol. II, "The Forests of India," by Professor E. P. Stebbing, which in view of the previous mis-statement, the author has now re-written, he has also added the following Author's Note :—

"The accompanying revised chapter is submitted for the original in which it was erroneously stated that no Valedictory Notification with reference to Sir William Schlich's services was issued by the Government of India on his retirement. The Author has expressed to Sir William his deep regret at the error. It was made on information whose authenticity he had no reason to doubt."

REVIEWS AND EXTRACTS.

PROGRESS REPORT ON THE FOREST ADMINISTRATION IN THE PUNJAB FOR THE YEAR 1921-22.

The Chief Conservator lays a good deal of stress on the need for new working plans and for the revision of plans which are out of date. Without suggesting that the present working plans are satisfactory it is difficult in reading through the report to avoid coming to the conclusion that what is even more required is a definite programme of Silvicultural research. We are told that owing to the shortage of labour and the depressed state of the timber market the carrying out of existing working plan prescriptions has generally fallen somewhat in arrears. The history of the working of the deodar forests has been firstly the selection system, than the selection in groups followed by the group system, each in turn given up owing to unsatisfactory regeneration and the realisation that if any works to assist regeneration are undertaken they must be thorough and continue until the objects have been achieved. History will repeat itself with the fir forests if, as we read in paragraph 73, research work on regenerating spruce and fir forests is interrupted merely because the produce is at present unsaleable. It would have been far

better if in the past instead of blaming the working plan for lack of regeneration and spending much time and effort on making a new one which it was fervently hoped would prove better but which in actual practice did not, the problem of regenerating deodar had first been seriously tackled and when solved, the working plan revised on the basis of some definite knowledge. This would have avoided a good deal of groping about in the dark and the continuation of the selection system would have been far better for the forests than the introduction of so-called more up-to-date methods followed by equally inadequate reproduction. Surely now that the prescriptions of existing plans are somewhat in arrears this is just the time to slacken off working plans and try to make up some of the leeway in silviculture. It cannot do any harm knowing how to regenerate spruce and fir forests a few years before they can be profitably worked. As a matter of fact, spruce and fir have been profitably worked both in the Murree hills and in Kangra for years past and in both localities regeneration has not been obtained as a result of the working.

It is very sad to read of the serious damage done to the Changa Manga plantation owing to shortage of water in the canal. This is not the first time the plantation has suffered in years of deficient snowfall in the hills and one can safely prophecy that it will not be the last. We therefore think that there is no justification in proceeding with the Shahpur-Jand extension of Changa Manga. According to form 18 this extension is only 83 acres so far, and has cost less than Rs. 3,000. Why not give it up now before more money is lost on it? In a year such as the one under review every acre of the extension is irrigated at the expense of at least one acre of the existing plantation. Moreover most of the area available was sown up many years ago and abandoned owing to shortage of water so that there is a useful precedent for this course and precedent always carry great weight with Local Governments. The matter would need to be explained to the Local Government as from their review they evidently do not grasp the position. In the review it is stated that "if irrigated plantations are established

on the development of the Sutlej Valley Project it will be important so to locate such plantations as to insure a *minimum* supply of irrigation. "The location of the plantation on the canal really has nothing to do with it. Most of the Punjab canals are designed to carry considerably more (about twice) the minimum discharge of the river they take off from. The area commanded is usually very much greater than the area irrigated which depends upon the normal minimum discharge of the river. This minimum usually take place in the winter when water goes very much further than it does in the hot weather. Normally with the melting of the snow the river rises and exceeds the full supply of the canal, at this time the winter crops are being reaped and the rains crops are mostly not in the ground so that water is to spare and this goes to the plantation if there is one on the canal or is not taken into the canal at the head and runs to waste in the river. Occasionally in years of deficient snowfall the river does not rise and water is short in the hot weather. The Canal Department do the best they can under the circumstances and cut every one including the Forest Department down. The cultivator meets the situation by not sowing as much as he would like to and the Forest Department may have to leave some of their plantations unirrigated with disastrous results if the monsoon is late or fails. Clearly the only way to meet the difficulty from the point of view of the Forest Department is to let the plantation have the first claim on the water and to give the balance, if any, to the cultivators We doubt if the Local Government would be prepared to ensure a minimum supply in this way even if the Forest Department recommended it, as well they might, seeing that their crop takes 20 years or more to mature whereas those of the cultivator take usually not over 6 months. There is another way out of the difficulty not applicable in the case of Changa Manga but which should be considered in the case of any new plantations and that is to locate the plantations in an area where the subsoil water is about 15 feet below the surface of the soil. Plantations in such places are not likely to suffer so seriously in years of short rainfall as those on high ground with a deep subsoil water table.

The attempt to show the Financial position of the Department in such a way that the real results of the years' working may be seen is to be commended. A statement such as the one shown in paragraph 58 is likely to do away with the customary comments on the surplus as shown in the books and the usual jugglery with figures to show that had it not been for this, that and the other items, the real surplus would have been something quite different. The main objection to the calculation made by the Chief Conservator seems to be the entire absence of any provision for depreciation on capital expenditure. This will obviously lead in the end to an inflated capital much of it representing the cost of works that no longer exist or have fallen into disuse. For instance according to Appendix VI some Rs. 2,500 has been spent on olive cultivation and this item is debited to capital expenditure as presumably has all previous expenditure under the same head. In paragraph 74 the abandoning of the olive plantations is foreshadowed. Under present arrangements the department is saddled with paying 6 per cent. interest in perpetuity on all the money sunk in olive experiments. Similarly the forest revenue of the province is to be burdened with the interest on Rs. 130 spent on working plans during the year. Modern so-called up-to-date working plans are rather ephemeral things and frequently require revision before they have been long in force and if the cost of making them is to be debited to capital a substantial depreciation charge against revenue is indicated. According to the Local Government review the advice of expert accountants is being sought with the object of putting the system of accounts in commercial shape and when they have been to work, Appendix V will doubtless disappear in its present from. It is difficult to see any use for a form which shows all the valuable divisions in the hills with big deficits and one depôt division with a bigger surplus than the whole province.

R. N. P.

FORESTRY IN FRANCE.

II.—La Grande Forêt de Tronçais.

[By Professor E. P. Stebbing.]

After the French Revolution the Forest of Tronçais had suffered from all kinds of abuses, owing to the decline of all authority in the provinces. Under the 1779 plan another 20 years' supply of wood should be available for the iron works, whereas in effect only two—three years' supply existed, a glaring example of the improvidence which usually accompanies commercial undertakings when they are given a more or less free hand in exploiting the forests in their neighbourhood. The central reserve at this period practically formed the only forest of any value left. The inspecting officers drew up a set of recommendations for the improvement of the destroyed areas; but, as these were still subject to the 40-year lease, nothing was done. It was not till 1835 that the next measures were undertaken, followed by those of 1868, which are actually in force. The results observable to-day, which are the outcome of these measures, furnish remarkable lessons for us at home.

If one were asked to enunciate the principles of a true forestry policy in few words they could be expressed as continuity of working, a sound knowledge of forestry science in all its branches, and a wide administrative outlook. For the absence of any one of these will lead to mismanagement. Troncais and the Forest of Dean furnish many illustrations of the truth of these axims.

In a previous article it was shown that a great reserve was created in the central part of the forest which the east and west sections were destroyed to provide wood for the ironworks. It is proposed to glance briefly at the measures undertaken from 1835 onwards with the objects of restoring these areas.

Its Situation and Character.

The forest of Tronçais occupies an undulating plateau divided into three parts by the rivers Marmande and Sologne with a general trend northwards following the slope of the Bourbonnais plateau, the elevation varying from 700 to 1,200 feet. Several

knolls give the country a hilly aspect. In the south the plateau rests on the Primary and Archaic strata. To the north-west it lies on the more recent Lias beds, which stretch along the borders of the forest and are mostly under coppice forest in private ownership. These Lias beds are rich in fossils. The central part of the forest is underlain by the Trassic strata. These occur in large masses without any definite strata. and are red in colour from the decomposition of ferruginous clays and sandy loams. Outcrops of almost pure clay lead to the formation of spongy, ill-drained patches locally termed "terres boulaises." The manner of treating these forms a most instructive study for foresters. The impermeability of areas of pure clay account for the presence of several large natural lakes and artificial reservoirs in the district. This brief exposition of the topography and geology of the forest is necessary in order to arrive at an appreciation of the lines upon which the restoration work proceeded after 1835.

They have a pleasing custom in the French Forest Service of naming the "Rond-points" or meeting places of several roads in a forest after distinguished officers. Thus young forest officers and students working in the forests have ever before their minds the great examples of the past. Troncais is no exception, and the Edinburgh University forestry students, who spend over two months on a practical course in this forest and neighbourhood, became well acquainted with such names as Desjubert, du Guiny, and de Buffevent.

This year a new "Rond" was inaugurated, and given the name of a great French forester and silviculturist, Mons. R. Raffignon, who has spent forty years of his life in Tronçais. Edinburgh University had the great good fortune and honour to be invited to assist at this ceremony of the dedication of the "Rond Raffignon," the whole of the French Forest Staff and other dignitaries being present.

To come back to the forest. In the year 1832 its condition was as follows :—(1) 11,250 acres, including the reserve, in fairly good condition ; (2) 10,000 acres ruined, and fit only for grazing ; (3) 6,000 acres of blanks.

The Scheme of Administration.

In 1835 a new working plan was framed by Monsieur de Buffevent. He prescribed the regeneration of the reserve, subject to a possibility by volume, in 60 years' improvement fellings in the east and west sections, and the reafforestation of blanks. A scheme of road construction and drainage was also prescribed. A network of some 200 kilometres of drainage ditches along the horizontal outcrops of clay was constructed. Regeneration was obtained, or attempted, in various ways. On areas of good soil near the outer boundaries of the forest, concessions were given for 4—6 years to neighbouring agriculturists. They were allowed to raise crops on the area granted, on condition that during the last year of the concessions they sowed the area up with acorns, the latter being supplied by the Forest Department. The areas so reafforested have produced some very fine oak pole woods which have since been mostly underplanted with beech. The same class of work was undertaken by the Department itself on areas situated within the forest, and too far from the outer boundary to make it possible for cultivators to take up concessions The poorer, dry, or wet soils were reafforested in part with maritime pine. The method of dealing with these tracts, of which we have extensive expanses of a similar nature at home, is very instructive. The Scots pine had, later on, to be substituted for the maritime. The success attending this work has been remarkable, and the crops produced were of inestimable value in the Great War, as the Americans, who left their trail across this countryside, could well vouch.

That the good work carried out on de Buffevent's plan bore fruit is evidenced by the survey made in 1868 by MM. Bernard and Buffault. This inspection showed a marked improvement in the areas under true growth, and in the condition of the forest generally, as follows:—(1) 17,500 acres of thriving crops; (2) 7,750 acres of mediocre woods; (3) 2,000 acres of blanks. The survey made by these two officers led them to form the conclusion that the forest was being called upon to yield a much higher output of first-class oak timber than the large proportion of younger age classes present warranted. A more conservative felling in

the old oak stands was recommended. A new working plan was accordingly prepared, and this plan with its revision made in 1898 is still in force. Under the provisions of the plan the forest was divided into six independent series, with a rotation of 144 years in three of them, and 180 years in the other three; a subsequent modification applied the 180 years rotation to all the series or working sections. Each of the latter were divided into six periodic blocks, 30 years being allocated (on the 180 year rotation) to each block. The plan prescribed working by the uniform or shelter wood compartment system of successive regeneration fellings, artificial aid being only given to plant or sow up places which had failed to become naturally regenerated.

The Sorts of Timber Grown.

The period allowed to obtain a new crop of trees over the block being regenerated was, therefore, 30 years. The chief species are oak, beech and hornbeam, with subsidiary ones, such as birch, willow, poplar, etc., which are cut out early. The oak is outgrown by the hornbeam (up to sixtieth year) and beech (up to eightieth year), and therefore requires constant protection against them during these periods. The oak is also very sensitive to spring frosts, which are very severe here, lasting up to June. Briefly when a compartment of the forest comes up for regeneration, the undergrowth, consisting of holly, brambles, *Lonicera*, advance growth of beech, etc., is cleared off and a seeding felling made in the old crop. The new crop appears more or less unevenly over the area. Owing to the frost danger to the young oak, the overhead cover of the old trees must be maintained as long as it is required for their protection. The old trees are, therefore, removed in several secondary fellings, followed by the final cut, when shelter is no longer required. Frost level height varies in Troncais from three to (in frost holes) five metres; therefore, the crop must have grown above these levels before it can be exposed. The work entails expert knowledge, since the working plan is based on finance and the volume of oak timber to be removed annually is fixed. When a "lot" of old trees is sold to a contractor, under the contract, after the felling and removal of the timber, he has to make a cleaning in the

young crop on the particular area. This is done under the supervision of the forest guard, all damaged young trees being cut back, and young beech, hornbeam, etc., interfering with the oak being topped or cut back. These cleaning operations have to be repeated (by the department) at intervals until the crop has reached the young pole stage. From this time onwards thinnings are made in it every ten years. The thinnings are marked by the gazetted staff. They yield a good profit, since everything down to small fuel and faggots is saleable. A considerable amount of pitwood for the French collieries is obtained from the thinnings. Most of the beech and hornbeam will have been removed by about the hundredth year, and an understory of these species comes in naturally. This grows up and thus prevents the stems of the oak producing epicormic branches, to the detriment of the timber.

How the Oak is Used.

As to the uses to which this magnificent oak timber is put? To many they may prove more interesting than the method of growing it. In addition to naval requirements, furniture and veneers, its chief raison d'être is for the production of staves for brandy and wine casks. Good cognac is kept in the cask for a long period. The wood for these casks must be straight grained, free of even small knots, and of a high density. The oak trees are felled, sawn up into the desired lengths, and the latter are then split, on the spot, into sections (like dividing an orange), with the crudest looking, though very effective, tools by adepts at the art. The section is then split into staves, which are planed to the required thickness. Top and bottom pieces for the casks are also prepared. Neat piles of these staves are to be seen in the forest at the present time on the spots formerly occupied by the great trees. There is no waste, as the shavings and rejected pieces are used as kindling firewood and other purposes, and the larger the diameter of the tree the less the proportion of the latter.

At first sight it may appear a rather sinful use to put such a magnificent timber grown with such skill. But inquiry into this aspect of the matter brings to light a number of industries

dependent upon the material grown, involving a considerable number of skilled forest and other workers. In its ramifications one realises that the production of this timber is essential to one of the large trades of the country—the wine and spirit trade. And the origin of the industry goes back as already mentioned to Roman times when the old leather bottles was replaced by the cask.

It has been noted that only the straightest fibred timber can be used, and that the staves are fashioned by hand by highly skilled workmen. Attempts have been made to cut the staves with the circular saw, but so far as high grade casks are concerned they have failed. If the saw, as it will, cuts across the medullary rays the cask will ultimately leak ; such a risk cannot be incurred where high-priced wines and spirits are concerned.

It is a most alluring study, the utilisation of the fine Tronçais oak timber, as interesting in its way as the methods by which it is produced, and the latter entail the most scientific practice of the art of the forester.—[*The Scotsmans.*]

THE REGULATED SELECTION FOREST.

BY SIR WM. SCHLICH, K.C.I.E., F.R.S.

It is well-known that the bulk of the 1,100,000,000 acres of forests in the British Empire are worked, if at all, under a kind of selection system. Owing to the unsatisfactory results obtained in many cases in the past, the system has become discredited, so that in many of such forests in Europe the system has been changed into others, more particularly in the so-called Uniform system and its modifications, or into the system of clear cutting in high forest followed by artificial sowing or planting. The Uniform system has many advantages, as it provides a shelterwood for the protection of the new crop, and leads to more concentrated working, but if seed years do not come when they are wanted, or the seed does not produce a new crop, artificial regeneration must be done, which is likely to cause a good deal of expenditure. The clear cutting system may lead to satisfactory results where the rainfall is favourably distributed over the year,

as it is in Great Britain, but where this is not the case the results may, and have been, disastrous. In many parts of the Empire droughts occur almost every year and in such cases clear cuttings should, in my opinion, be excluded. This has convinced a good many experienced foresters that, instead of abolishing the selection system, we should improve it, since that system provides permanent shelter to the soil and, if carried out in the right way, needs little or no outlay in the shape of sowing or planting. The latter point is of special importance at the present time owing to the high price of labour. These considerations have induced me to study the matter, and the following note is the outcome.

THE REGULATED SELECTION SYSTEM.

Description of the System.

Character of the System.—All size, or age, classes from one year old seedlings to the oldest classes are represented by single trees or small groups in all parts of the forest, and, theoretically, the work of selecting trees for cutting extends every year over the whole forest. In practice, however, the forest is divided into a number of blocks or compartments, which are taken in turn for treatment, so that the cuttings return to the same part of the forest after the lapse of a number of years called a "period." The size of the compartments and the length of the period depend on the intensity of management. The greater the latter, the smaller will be the compartment and the shorter the period. The natural regeneration of the forest is effected under the shelter of the old crop, especially where single trees or small groups have been removed. If natural regeneration fails here and there, artificial help is not excluded, though it is required only in exceptional cases.

The system secures at all times an equal protection of the soil, more especially as regards the preservation of a suitable degree of moisture. Protection is given not only from above, but there is also side shelter owing to the mixture of the several side classes in all parts of the forest. On sloping ground the rainfall is effectively retained; avalanches, the carrying away of fine earth, landslips, etc., are prevented or, at any rate, moderated.

As a consequence, protection forests situated in mountainous districts are usually managed under this system. All these matters act beneficially upon the producing factors of the locality, which is a substantial offset against any shortcomings of the system in other respects. Views differ somewhat regarding the extent to which selection forests are exposed to external dangers, as compared with the uniform shelterwood system. In the writer's opinion, the former is, on the whole, the more favourable, because only very small parts of the soil are at one time exposed to the injurious effects of the sun and air currents. Damage by frost and drought is smaller, and probably also that from wind and snow-break.

Owing to the conversion during the last century of considerable areas of selection forests into the uniform systems, comparative observations are somewhat scarce as regards the production of timber. These conversions are due to the belief that selection forests produce smaller quantities of wood than the Uniform system. It has, however, been recognised of late that this opinion was due to the fact that many selection forests were not managed as efficiently as should have been the case. At any rate, there are now some selection forests which, owing to careful and rational management, are equal, if not superior, to the uniform system. Young growth, no doubt, develops slowly, as it is much kept back by the older trees, but this is made good by more active development when it has reached the full enjoyment of light and the benefit of more favourable moisture conditions, secured by the continuous protection of the soil. There can be no doubt that in many cases the boles of the trees produced under the selection system are less clean of low branches than those grown under the uniform system; some species are also liable to suffer somewhat in height growth. These are serious shortcomings. On the other hand, the system is well adapted for the production of trees with a large diameter, as they can be left in the forest for any length of time.

The Management of the Selection Forest.

The successful treatment of the selection forest makes great demands on the forester. To obtain really good results, it is

essential that he should have a detailed knowledge of all parts of the forest, since he has so to say, to guide each tree throughout all stages of its life. All depends on his personal judgment in the selection of the trees to be left for further development, and of those to be cut, and when to be removed. It follows that the forester must be given great freedom of action, and yet his measures must fit into the framework of a general scheme of management, whenever a sustained yield is aimed at. Given a competent manager, all will be well, but, failing that, great mischief may be done; hence control is essential. There has been an outcry of late against all kinds of control of the local managers. It has been said: Away with all systems, away with rotation and what not, full and free liberty to the local manager! These are wild ideas, which are not followed in other branches of human activity, and they are certainly out of place in forestry, where forethought for future requirements during long periods of time is essential.

The details of a general working scheme depend on local conditions, but its main features must be laid down and observed. More especially the determination and regulation of the future yield must be settled by authority and not left to the personal ideas of the local manager. The following scheme may serve as an illustration:—

Determination and Regulation of the Yield.—The first important measure is to divide the forest into a suitable number of compartments. The size of these depends on the total area of the forest and on the intensity of management. Where the latter is well advanced, the compartments should be small. In the case of extensive areas and where the management is as yet of small or moderate intensity, it may be desirable to arrange the compartments into two or more working sections. The compartments in each working section should be consecutively numbered; that is to say, one series of numbers for each working section, if not for the whole forest.

Each compartment should be treated on its own merits, with due reference to the yield of the whole working section. If by

careful treatment each compartment is gradually brought to its highest possible production, all must be well in the whole forest.

The next measure should be to ascertain the exact condition of each compartment, and from that date to keep a separate account for each unit of division of all measures taken, and acts done within its boundaries. The establishment of sub-compartments should be reduced to a minimum. It there are differences of a temporary nature in a compartment, they will naturally disappear in course of time. If they are likely to remain permanently, it is much better to establish at once two compartments instead of one.

With a view to determining the yield capacity of each compartment and to lay down its further treatment, the growing stock must be carefully measured and classified. The latter process may differ in accordance with local conditions, but generally it would be done in the following way :—All trees down to a minimum diameter (or girth) would be carefully measured and their volume ascertained. These trees and their volume would be divided into several size classes ; in some cases into large trees, medium sized, and small trees ; in other cases more definite limits would be adopted. For instance : Let the minimum diameter at height of chest be 6 inches (or 20 inches girth) and each class with a range of 6 inches, there would be the following classes : First class, 6 to 12 inches ; second class, 12 to 18 inches ; third class, 18 to 24 inches ; fourth class, 24 to 30 inches, and so on. By numbering in this way, from the smallest class upwards, the number of each class indicates at once its limits, which is not the case by numbering from the largest class downwards. All young growth below 6 inches diameter is examined, so as to ascertain whether it is of sufficient quality to provide the required number of saplings to replace the larger trees which will be removed from, time to time ; if not, cultural measures are indicated.

Throughout all stages of treatment the yield must be intimately connected with the increment. The one must be equal to the other if the proportion between the classes is such that the objects of the proprietor can be indefinitely realised ; in other words, if the growing stock is normal. If there is a deficiency or

surplus of growing stock, less than the increment in the first case and more in the other case, should be cut for some time, until the normal condition is established. It is not possible to define the normal state of the growing stock by a formula as can be done in some other systems; it can only be described as that which yields permanently the greatest return of the class of timber desired by the proprietor. The normal state can be reached only gradually in the course of one or more periods, during which the forester establishes the proper proportion between the number of trees in the several classes, which should always consist of the most vigorous promising trees. Their number should be so that each tree is given enough growing space required for full development and no more, according to the size class to which it belongs, provided that the light required for the proper development of the young growth under 6 inches is given. For the rest, a full stocking of the area should be aimed at, so as to obtain a full return, and to produce as clean and well-shaped boles as may be possible under existing conditions.

The difficulty is to ascertain the increment which may be expected during the first period. An effort may be made to determine it by examining the increment laid on in the immediate past and adopting that for the immediate future, until more reliable data becomes available. The latter can be obtained only by re-measurements after short intervals, five or ten years. Let be the volume in the beginning = V_1, that after n years = V_n, and the Volume removed during the n years = Y, then the increment during the n years amounts to:

$$I = V_n + Y - V_1.$$

In this way the increment of each class, as well as the increment of the whole compartment during the first period can be ascertained. With every succeeding periodic measurement the determination of the increment becomes more and more accurate. In cases where the degree of intensity is very high, the investigation of the increment may be extended to single trees.

The procedure may be further illustrated by a small example:—Given a selection forest of 300 acres, such as a landed proprietor in Great Britain might possess, and assuming that it

has been divided into ten compartments of an average area of 30 acres each. Taking a typical compartment, it was found to contain a young growth, below 6 inches diameter at height of chest, fit to furnish the several classes above 6 inches with a sufficient number of recruits. These classes contained at starting the stock of trees per acre and their volume given in columns b, c and d of the subjoined table :—

TABLE SHOWING THE DETERMINATION OF THE INCREMENT.

Limits of Classes. Diameter, Inches.	Growing Stock at Start.			Growing Stock after 10 years and increment.					
	No. of Trees.	Vol. per Tree c.f.	Total Vol. c.f.	No. of Trees	Vol. f.	Vol. of cut Trees c f.	Total Vol. c.f.	Deduct first Vol.	Increment in 10 years.
a	b	c	d	e	f	g	h	i	j
I. 6—12 ...	90	10	900	90	900	200	1,100	900	200
II. 12—18 ...	40	25	1,000	41	1,025	400	1,425	1,000	425
III. 18—24 ...	15	60	900	21	1,260	120	1,380	900	480
IV. Over 24 ...	5	140	700	9	1,260	140	1,400	700	700
Total ...	150		3,500	16	4,445	860	5,305	3,500	1,805

There were at starting 150 trees over 6 inches diameter with a volume of 3,500 cubic feet, divided into the four classes as given in column b.

At the end of ten years the growing stock was re-measured for the purpose of obtaining the necessary data for the determination of the periodic increment. As it was not desirable to suspend cuttings during the first period, nor to overcut the compartment, the forester made the best estimate he could of the probable increment during the first ten years. He fixed it, after an examination of selected test trees, at 1,160 cubic feet. In consideration of the fact that the two older classes contained only 1,600 cubic feet, against 1,900 in the two younger classes, he decided to cut less

6

than the estimated increment, so as to increase the number of trees and the volume in the older classes in accordance with the objects of the proprietor. The amount actually cut during the first ten years amounted to 860 cubic feet. In this way the number of trees in the two oldest classes was raised from 20 to 30. Whether a further augmentation in the same direction is desirable will depend on further experience.

The results of the re-measurement are shown in columns e to j of the above table. The increment laid on during the first period amounted to 1,805 cubic feet per acre, equal to 180 cubic feet per acre and year, which has been fixed as the maximum yield during the second period of ten years. The same procedure is followed in the other nine compartments, one being taken in hand in each year. In the eleventh year operations return to the compartment taken first in hand. Assuming that the compart ment dealt with above represents an average of the ten compartments, the total average annual increment on the 300 acres would be equal to 54,000 cubic feet, which amount could be cut annually.

The area of the example is small, but similar results have been obtained by the adoption of the system on much larger areas, as, for instance, in the Oberwolfach Communal forest in the Black Forest, in Neuchatel in Switzerland, and in places in the Jura Mountains.

Foresters will be well advised to pay careful attention to the system. It certainly gives better results than the coppice with standards system as practised in Britain. It should be the recognised system in most of the colonies for many years to come, especially where long spells of drought are the rule and not the exception. No doubt many of the trees are liable to be somewhat more branchy on the lower part of the boles as compared with the uniform system, but that drawback can be met by pruning while the trees are still young. The pruning should be done in instalments beginning with the lower 10 or 12 feet at a comparatively early age, and carrying the operation upwards some years afterwards. By restricting the pruning to those selected trees which are destined to reach the older classes, the expense of the operation would be very small.

The system is applicable to all shade-bearing and moderately shade-bearing species. It is less suitable to light-demanding species, because they would have to be given so much growing space that the protection of the soil and the preservation of a suitable degree of moisture would be seriously reduced.—[*Empire Forestry Journal, April* 1923.]

RE-AFFORESTATION IN KENYA COLONY BY MEANS OF SHIFTING CULTIVATION.

By H. M. Gardner,

Assistant Conservator of Forests.

In his recently published report, Professor Troup states that he considers the Forest Department is to be congratulated on the efficiency and cheapness with which the planting work is being done in Kenya Colony. A brief description of the methods employed may be of interest to foresters in countries similarly situated.

Advantage is taken of the native's system of shifting cultivation. The system is of course practiced by uncivilised tribes in many countries and the following is merely a description of how it is turned to account in Kenya.

In Kenya there are no real forest tribes. The forests are uninhabited except for a few Wandorobo who exist entirely by hunting, living a wandering life not in settled communities and in numbers certainly not reaching one per square mile. There are other tribes, however, notably the Wakikuyu who are great cultivators and are very willing to come and live in the forest where they get rich forest soil for their crops and plenty of free fuel, which latter is very scarce and expensive in their own reserves.

The admission of native squatters into the forest is controlled by the Resident Natives Ordinance which applies equally to farms and forest reserves. Under this Ordinance only such number of native families are allowed to reside on a farm as is permitted by a magistrate after due enquiry into the labour

requirements of the farm, it being compulsory under the Ordinance for each adult male squatter to do 180 days work in the year for the owner at the rate of pay stated in the agreement. In return the owner has to provide sufficient ground for the native's own cultivation and grazing for his stock. For forest squatters a clause is added that the squatter must cultivate only such land as is marked out for him, must keep his *shamba* (*i.e.*, field) clean, and must tend any trees planted in the *shamba* until such time as by reason of the growth of the trees it is no longer possible for him to plant crops in the *shamba*.

The aim of the Department is to have at least 200 families of squatters in each forester's district, but in some districts owing to ill-informed opposition by the European settlers it is difficult to induce the magistrate to grant a permit for so many, and in these districts planting is still in a backward state. There are only two large cultivating tribes that are as yet of much account in the labour market, these being the Wakikuyu and the Kavirondo. They are both equally good cultivators and workers but whereas the Wakikuyu brings his family and makes his home wherever he goes, the Kavirondo only leaves his reserve for the purpose of earning money. He will not settle down and make a home outside his reserve and rarely brings his family with him and is therefore of no value in the Department's planting schemes. Fortunately the Wakikuyu of recent years have shown great keenness to leave their reserves and willingness to penetrate and settle anywhere even in the remote parts of the Colony if they can get good land to cultivate there

When a native applies to be taken on as a squatter he is, if the quota for the district is not yet complete, sent before a magistrate to sign the agreement under the Ordinance. He is then shown where to build his hut, usually in the nearest grass glade to the area that is to be planted, and the piece of ground that he is to cultivate is marked out for him. The squatters are grouped together in two or three locations at points conveniently situated with regard to present and future planting sites and areas of bush or grass are set aside for the grazing of their stock. Great opposition is often manifested by settlers and others to the

admission of native squatters into the forests, on the grounds that once in the forest they become hidden, are under no control, afford a harbourage for all the bad characters in the locality, and are very liable to live by thieving from neighbouring farms, all of which allegations though persistently affirmed are entirely unfounded. Particular care is taken to see that all squatters are grouped in compact locations in places readily accessible for supervision, that no strangers take up their abode in them and that all lazy or doubtful characters are weeded out and sent back to the reserves.

The area to be planted is usually bush where the forest has been clear-felled for timber or railway fuel, or has been burnt out or otherwise destroyed. Each squatter is given on the average, about 2 acres, the area depending on the number of his womenfolk. It is a mistake to give large areas as, though the native will probably ask for more and clear it, yet experience shows that 2 acres is about the maximum that he can keep clean. The man clears the bush and plants his crops, usually a thorough mixture of maize beans, peas and potatoes. Eighteen months after the ground is given out, it is planted by departmental labour with young trees usually 1-year-old nursery transplants. The squatter continues to keep the *shamba* clean and to plant crops between the trees for at least another 12 months, by which time the trees are too big to be affected by any weeds except climbers. During this year the squatter is given another 2 acres of ground to break up, which will be planted with trees 18 months later, and so the work goes on. With 200 families of squatters an average of 200 acres a year can be planted up with trees.

The departmental labour for all purposes is drawn from among the squatters who turn out for work when called upon up to a maximum of 180 days in the year. They are paid when at work the local rates of wages, usually 10*s*. per mensem. In the formation of plantations the only expense to the Department besides the raising of the trees (which is about 8*s*. per acre), is the cost of staking out and pitting the ground and planting the trees. This cost is not more than £1 per acre and usually less. There is also the cost of creeper cutting, till a close canopy is formed. It is estimated that the total cost of formation and maintenance of

plantations until thinnings begin, including forester's salary and proportion of head office expenses, is about £3 10*s.* 0*d.* per acre. If squatters are not available and the ground has to be cleared and plantations kept clean by departmental labour the cost is almost exactly double.

The system has many advantages besides the cheap cost of planting, the most obvious being the insurance of a steady supply of labour and an ample reserve which can be called out at short notice at critical periods such as the planting season or in emergencies such as forest fires. It would seem that the system could profitably be introduced into all Colonies with similar native populations, but indeed it is so simple and its advantages are so obvious that it is probably more widely spread than the present writer is aware of. It does, however, presuppose a population with an unsatisfied land hunger or a "wanderlust," and it is possible that Kenya is exceptionally fortunate in the posession of Wakikuyu the tribe to whose needs the system seem to be as admirably suited as it is to those of the Forest Department.—[*Empire Forestry Journal, April* 1923.]

CORRESPONDENCE.

THE FOREST RESEARCH INSTITUTE, DEHRA DUN.

A Reply to Mr. Alexander Howard.

SIR,—I have read with interest a letter by Mr. Alexander Howard in the October *Indian Forester* in which he makes comments on an article on the Forest Research Institute contributed by Mr. Dalley to a previous issue of the same publication. Mr. Howard's criticisms are of the more value in that he has a thorough knowledge of many Indian timbers, and has been most successful in putting some of them on the European market. There are, however, one or two points in his letter which require remark.

In the opening part of his letter he says, that the Forest Research Institute would be well advised to imitate the example

of the Madison Laboratories and get into touch with the commercial world; and work in such a way that the results of the experiments are applicable to the needs and necessities of commercial life, it is some years since we have had the pleasure of seeing Mr. Howard at Dehra Dun, and perhaps he may not be quite up to date as to what is going on at the Forest Research Institute. The fact is, however, that we receive from 2,000 to 3,000 enquiries annually from commercial firms, which will show him that we are not altogether out of touch with the commercial activities in this country; while the number of enquiries received would tend to fall off and not continually increase if the information supplied was not what was required. What Mr. Dalley no doubt had in his mind when he said that "some idea of working costs and working conditions on a commercial basis must be obtained if any real progress is to be made" was that up to date, with the exception of the Section of Timber Testing, we had no large experimental plant working to carry out such tests as would give us figures of cost. The new Laboratories are now completed, an expert staff has been engaged, and we may hope in the near future to be able to cope with the work that accumulates day by day. It may interest readers to know that there is now a complete Section of Seasoning at the Forest Research Institute with three steam and four Sturtevant experimental kilns, a well equipped pressure creosoting plant, a timber testing shop with twelve up-to-date machines, an experimental veneer plant, a pulp and paper plant which can turn out 36″ sheets of paper, a wood workshop and a small sawmill fitted with up-to-date machines for supplying all the experimental sections. Each plant is sufficiently large to give semi-commercial results from which the cost of manufacture can be calculated, though no plant is worked commercially but purely experimentally.

Mr. Howard gives a list of timbers successfully kiln-seasoned by him in the United Kingdom, and I can personally testify to the most excellent work he has done in this connection. Mr. Howard then states that "I cannot see what advantage there can be in experimenting or demonstrating with a process which differs in any respect from one which is commercially practicable" I was sent some years ago by the Government of India to the United

States of America to buy machinery and to recruit men for this Institute; and when visiting the Madison Laboratories I was shown a number of very intricate seasoning kilns. At that time I said precisely the same thing as Mr. Howard, and in addition I said that such kilns were quite out of the question for commercial use in India. I was then taken to see a set of 8 and another of 120 kilns worked by two commercial firms, which had been based on the Madison kilns and their construction designed for the firms by the Madison officials. These kilns were quite simple and easily operated, as humidity and temperature standard charts had been supplied by the Laboratories. The reason for this is easily explained. Madison having elaborate kilns in which control could be regulated to a nicety were in a position to experiment on the timbers which the companies had to deal with, and were therefore able to prepare standard charts for each class of timber. After that it was an easy matter to design simple kilns which could be controlled to follow the standard curves of humidity and temperature.

Mr. Howard also states that "all that is required for seasoning Indian timbers can be achieved with an ordinary commercial kiln such as, as I have already said has been working successfully in London since 1919". This I agree with provided one has first ascertained how it is to be done for timber subjected to a tropical climate. A point that Mr. Howard has not touched on is that the effect of climate on timber in England and in India is very different in the two countries. As an illustration I may state that a table and other smaller articles which were, I understand, made of kiln-seasoned timber in England and exhibited by Mr. Howard at the Empire Forestry Exhibition, when sent out to India, simply went to pieces in the first hot weather.

Mr. Dalley's statement that "the public (in India) is on the whole ignorant of the kinds, qualities, quantities and prices of valuable Indian timbers and the localities where these timbers can best be obtained" is in some ways true and in others quite contrary to the fact. A glance at the *Indian Forester* Trade Supplement will go to disprove his statement. This brings me to Mr. Howard's last statement, in

which he informs us what he has done as regards *publicity*. He has done more than anyone else to help to bring before the public in England the value of our Indian timbers, and it is in this connection we might well take a leaf out of his book. We have recently given lectures on Seasoning in Calcutta and Timber Testing in Bombay, which have had very beneficial effects; but much more requires to be done, and now that we have just completed our new laboratories and workshops we are in a position to get to work and the sooner a publicity campaign is started the better. In this connection it might not be out of place to say that the Chief Commissioner for Railways visited Dehra Dun a short while back, and in his official report on the visit he speaks as follows:—" In the short time at my disposal it was not possible to see the whole of the activities of the Institute, but I am satisfied that it is doing work which is potentially of the greatest possible value to Railways in connection with their timber consumption."

R. S. PEARSON,

Forest Economist.

POPLAR AVENUE ON THE MOTOR ROAD FROM RAWALPINDI TO KASHMIR.

SIR,—*Country Life* of July 7th last published a letter signed "A. W. Learmand" with a picture representing an avenue of poplars on the main motor road from Rawalpindi to Kashmir, said to be 50 miles long. The picture shows what is clearly a tree with cylindric clean stem with nearly white bark and this cannot be the "Lombardy Poplar" which all the books mention as being planted in avenues in Kashmir. The trees are obviously not very old, perhaps hardly 30 years and I and others think that they must be the fastigiate form of *Populus alba* which is known in Europe as *P. Bolleana*, Carrière or perhaps they might be planted *P. Canescens* though I believe that tree, the most common white poplar in England, is rarely, if ever found, in India.

Can any of your correspondents who know Kashmir, throw any light on the subject and tell us all about this wonderful avenue, perhaps obtaining specimens of the leaves to ensure accurate identification. ?

J. S. GAMBLE.

YOUNG FOREST OFFICERS AND OLD FOREST FORMS.

SIR,—I have recently heard much scathing criticism of the methods, procedure and forms of the Forest Department from junior members of the Service. The criticism was nearly all directed against an impersonal "Government," the most general forms of expression being "Government are the limit," "why do we have to.........," and "why does Government do not do" or "why does the Government not do."

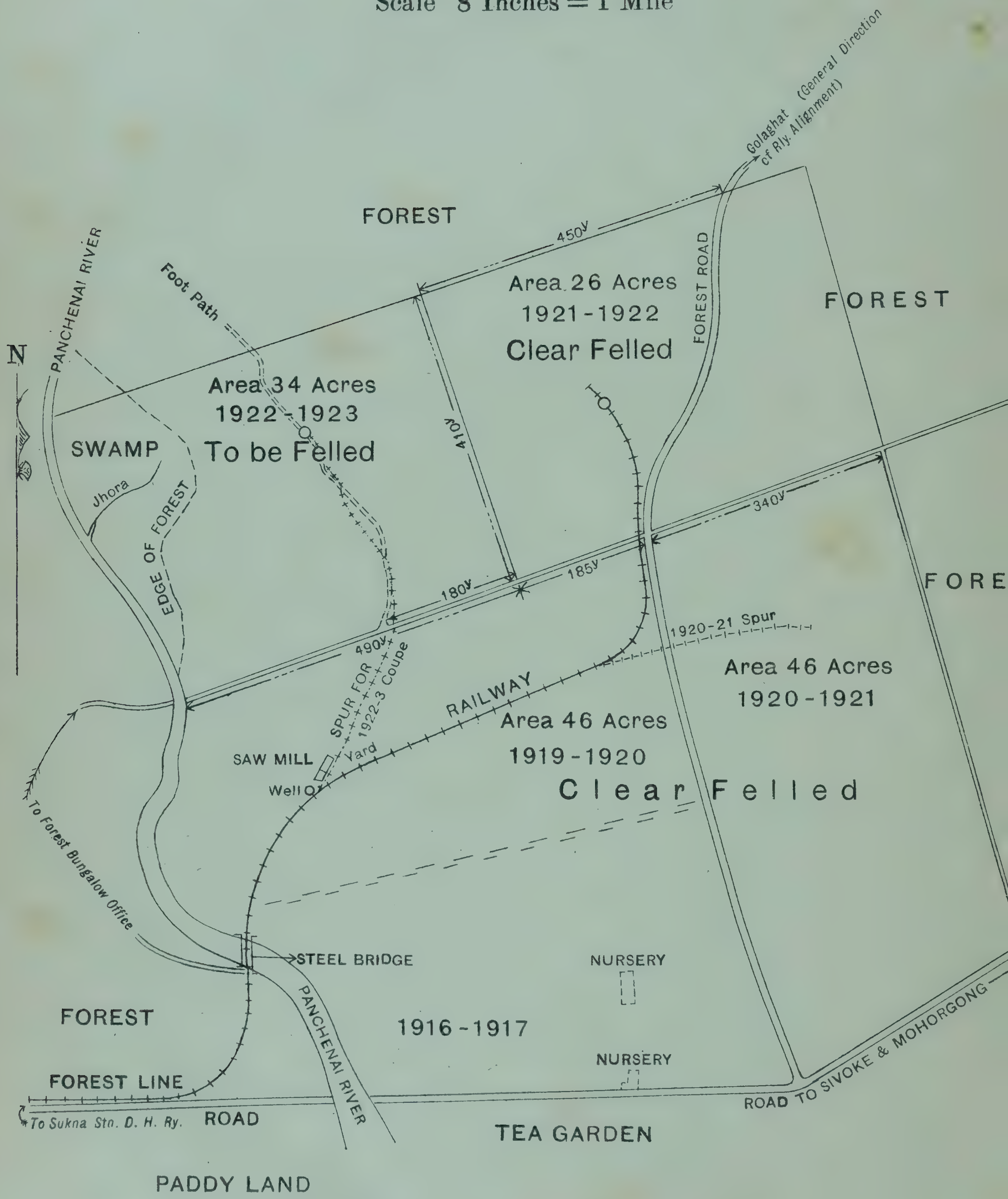
Be it very far from me to impute perfection to the impersonal "Government," but much of the criticism is based on a lack of information and is rebutted by facts, and most of the remainder hits the Service and not the "Government." This is indeed hard to bear, for "the fault Brutus is not in our stars." We have to fill up futile forms because *we* have not got them abolished or replaced by better ones, we have to follow an out-of-date and involved procedure because *we* have not brought forward an up-to-date and improved one.

May I suggest to them, through you, that if our zealous members would employ some of the energy spent in destructive criticism of the "Government" in evolving perfect forms and procedure, they might render tolerable and even happy the few years of service remaining to

SENEX.

MAP OF SUKNA OPERATIONS.

Scale 8 Inches = 1 Mile



VOLUME XLIX NUMBER 12

INDIAN FORESTER

DECEMBER, 1923.

FOREST OPERATIONS AT SUKNA, KURSEONG DIVISION, BENGAL.

INTRODUCTION.

Our object in publishing this account of the exploitation and re-stocking work at Sukna is to show the possibilities of using mechanical methods for extraction and conversion on a sufficiently small scale to enable the *taungya* work to be satisfactorily carried out.

The idea has existed that for a sawmill to be commercially successful, it must be of large capacity to justify the employment of skilled labour (sawyers, filers, etc.) and therefore the supply of logs must likewise be large, usually larger than can be arranged for in most of our Indian forests on a silviculturally sound basis. This idea which has resulted in a certain amount of antagonism being felt between the mechanical and the silvicultural enthusiasts among us.

The aim at Sukna is to balance the exploitation and the silvicultural sides of the operations so that the restocking by *taungya* keeps pace with the extraction and conversion plant working up to its economic capacity.

This balancing feat is not so simple as it seems, for the same very small labour force has to work both branches but it has been possible to do so quite conveniently in the following manner, the softwoods, readily liable to insect and rot damage, are sawn up as soon as felled and converted into timber and planking during the cold weather months,—October to the end of March ;

the hardwood, sal—not readily subject to decay and insect damage is skidded in from the coupe to form a large dump at the railway siding during the cold weather; in April and May the whole of the labour force has been turned on to the restocking work.

In the rains proper, the skidder crew is employed in loading and despatching the sal logs in railway cars and the sawmill is used for sawing up these logs into timber and planking.

A small mill such as at Sukna of American manufacture with an English portable steam engine can be had for just under Rs. 20,000 F. O. R. Calcutta and when once the labour has been shewn how to operate the various machines, very little skilled supervision is needed.

The inserted tooth saw saves the need of employing a skilled saw fitter and filer, whilst by adopting a good water spraying arrangement on the large main saws, the danger from overheating and loss of "temper" is largely minimised. The mill at Sukna has now been running since last October, save for a break of two months during the busy planting months of April and May with a crew consisting wholly of forest villagers under locally recruited carpenter-mistri. The skidder, fitted with a rehaul line, has been run entirely by these forest villagers.

A form of stump jumping plough has been designed and is being constructed to be worked by the skidder, by which means it is hoped to avoid the labour shortage during the restocking period and also to enable the yearly coupes to be increased in size for the areas are at present limited by the amount of labour available for this planting work. Even with the existing size of coupes, however, the results obtained during the past year are regarded as satisfactory from both the mechanical and the silvicultural points of view.

PART I.—LUMBERING AND EXPLOITATION WORK.

General.

The objects of the experiments at Sukna are to determine whether in small clear-felled areas of from 30 to 80 acres

mechanical methods of extraction and conversion of forest produce on American lines are more profitable and satisfactory than the existing hand sawing and bullock cart transport, and, further what type of machinery and plant is best suited for such work.

The area in which the experiments are being carried out is the clear-felling coupe of the Sukna Sal Working Circle, where the prescribed annual area is 50 acres.

This district is typical of the comparatively flat foothill forests of Bengal ; on account of the climate, labour is scarce and difficult to retain throughout the year, so that the successful use of labour saving machinery and devices will enable a large percentage of forest produce, which would otherwise have a very small market value to be utilised and to provide a source of revenue to the Department.

By the concentration of work into areas for clear-felling many advantages arise, one of the most important being the ability to construct a proper means of communication (here a railway line) from forest areas, which would otherwise be regarded as practically inaccessible, to markets for forest produce.

General layout at Sukna.—The general layout at Sukna consists of :—

1. A railway spur from the main D. H. Rly. line at Sukna station and extending at present into the forest just one mile.
2. An improvised skidding machine, *i.e.*, a machine for hauling in the logs from the tree stumps to the railway line, where it there loads them on to log cars, specially built for this work.
3. A small semi-portable sawmill, of American manufacture and plan, set up alongside the railway line, where it is fed with softwood logs for conversion into tea-box, planking and shooks during the cold weather and for small sal log sawing during the rains.

The Railway.—The railway line has been laid and is maintained and extended where necessary by the railway company

free of charge to the Forest Department in consideration of the freight earned on the carriage of—

(*a*) sal logs to Siliguri.

(*b*) box planking for tea gardens mostly on the hill section of the railway and around Kurseong.

(*c*) fuelwood likewise for tea gardens mostly in the hills.

The Skidder.—The machine purchased for the hauling in of sal logs from tree stumps to the railway line, where they are loaded on to railway log cars, is an old single drum and single cylinder pile driver, and for many mechanical reasons has not enabled the full advangates of mechanical methods of extraction to be demonstrated, but it has nevertheless shown the following results :—

(*a*) *The uncertainty of supply of bullock carts is overcome* (moreover the carts available in this district would be insufficient for the removal of the produce from such an area as at Sukna).

(*b*) *A saving of from annas 1 to 1·5 per c.ft. of sal sent by* rail, compared with bullock cart rates

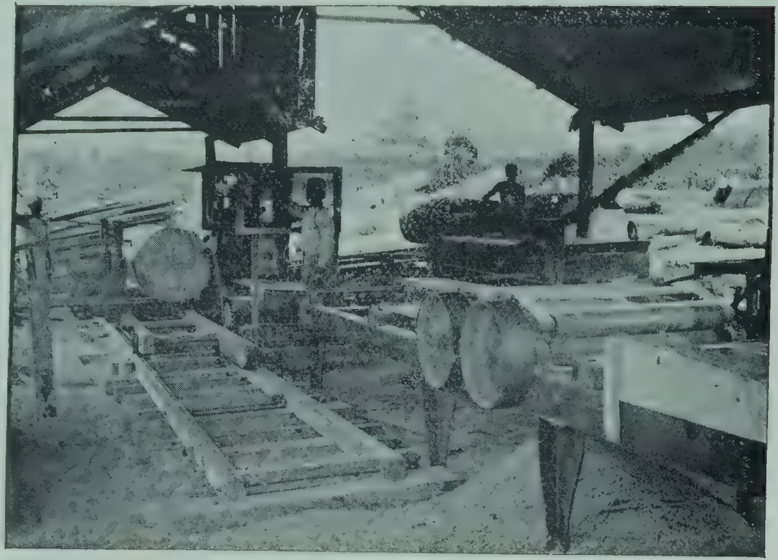
(*c*) Much larger logs can be handled by machinery than is possible by hand and bullock cart giving an enhanced value to the timber of from 8 to 12 annas per c.ft.

In 1923, 34,000 c.ft. or 1,060 tons of sal timber will be sent to Siliguri. Thus, Rs. 20,000 will be saved on freight, whilst the enhanced value of the timber will be about Rs. 17,000.

The Sawmill.—The small American sawmill was purchased in 1920, for the manufacture of tea-box planking from the soft wood logs felled in the Sukna coupes.

A short trial run was made towards the end of the hot weather in 1922 to determine what additional machinery was necessary to enable the plant to run efficiently and economically.

The whole of this machinery did not reach India from America before 1923, but sawing operations were commenced in November 1922 and have been continuous, save during the



1. Interior of sawmill—sawing up *simal* logs.

2. General view of the felled area 1922-23, showing the skidder moving itself into position.

3. General view of the skidder, at work by the railway line.

4. Sal log 32 feet long, weighing over 3 tons.

installation of the new machinery, which necessitated altering the layout of the mill considerably. From November till the middle of March 1,50,000 s. ft. of half inch tea-box planking have been sawn. With the installation of the new machinery, the daily output has increased whilst the crew and consequently the cost sawing has been considerably reduced. The present arrangement is regarded as fairly suited for such localities and conditions.

The Crew at present consists of :—

			Rs.	P.M.
1	*Mistri* (part-time with skidder 2/3rds debited to mill) ...	on	50	„
1	engine driver ...	„	25	„
1	water pump man ...	„	15	„
1	main sawyer ...	„	16	„
1	edger sawyer ...	„	15	„
1	trimmer sawyer ...	„	15	„
1	scaler and take-off man	„	15	„
1	yardman stacking planks.	„	15	„
1	boy stacking, etc. ...	„	9	„

The monthly wage bill is Rs. 158-5-0 and the daily wage bil is Rs. 5-4-0.

The following figures give the output from March 1st to 23rd :—

1. 1,795 s.ft.	Actual days sawing ...	17·5
1,260 s.ft.	Holidays and fire work ...	2·5
1,440 s.ft.		
1,404 s.ft.		
530 s.ft. (crew on fire work.)	Bazaar days... ...	3·0
1,840 s.ft.		
1,360 s.ft.		
3,000 s.ft.		
1,180 s.ft.		
1,374 s.ft.		
1,888 s.ft.		

250 s.ft. (crew on fire
1,830 s.ft. work).
1,780 s.ft.
1.940 s.ft.
1,822 s.ft.
1,326 s.ft.
1,520 s.ft.

27,530 sft.

The average output during 23 days was 1,200 s.ft. a day, and the average output for 17·5 sawing days was 1,570 s.ft. a day.

Cost of sawing by the Sawmill.—The total cost of the plant in use at present amounts to Rs. 13,100.

Allowing a depreciation of 12½ per cent. per annum for the whole mill and Rs. 360 per annum for repairs, and also, that the output from the mill averages 1.200 s.ft. per diem of softwood box planking (and an equivalent figure when sawing salwood), the cost of sawing is made up as follows :—

Item—		per 1,000 s.ft.		
		Rs.	a.	p.
Depreciation charges a 12 1/2 per cent.	...	3	12	0
Repairs at Rs. 360 per annum	...	0	14	0
Labour at Rs. 5-4-0 a day ...	...	4	6	0
Loading, planking into cars ...	...	0	4	0
Fuelwood for engine from coupe	...	0	14	0
Felling, dressing and carting at as. 2 per c.ft. of log and allowing 50 per cent. wastage.		10	6	0
Royalty at as. 3 per c.ft. log, ditto	...	15	9	0
Total cost	...	36	1	0
Average selling price	...	41	0	0
Profit to the Department per 1,000 s.ft. planking	...	4	15	0

Handsawing at Sukna is expensive and there would be an insufficient number of sawyers to convert the whole of the softwood felled each year into planking to give it its full market value. Owing to the high rates for handsawing, what softwood is converted into planking yields no profit nor is the full royalty value of the timber realised to the Department.

The sawmill converts the whole of the softwood timber felled each year in the coupes and not only enables the full royalty value of the timber to be realised, but also yields a profit of practically Rs. 5 per 1,000 s.ft. of planking sold, as it is being run at present.

Otherwise expressed, by selling softwood in the form of planking four annas are obtained for every c.ft. of log instead of three annas by selling it in the log.

1923 Season.

175,000 s.ft. of box planking will be sawn altogether this year.
100,000 s.ft. was sawn before mill was completely reorganised.
75,000 s.ft. will be sawn at a profit of Rs. 375.
100,000 s.ft. first sawn, only enabled royalty values to be realised.

Revenue from this year's working is therefore—

			Rs.
Royalty only on 100,000 s.ft.	...	...	1,556
Royalty only on 75,000 s.ft.	...	...	1,160
Profit, clear, on 75,000 s.ft.	...	...	375
Total for the Season	...	...	3,091

(The mill will be turned on to sal log sawing, when the softwood supply is finished.)

Fuelwood.—The fuelwood is prepared from branches, tops and débris in the coupes and is sent in long open bogie cars, containing 850 c.ft., to tea gardens mostly in the hill section of the railway round Kurseong. As with tea-box planking, the demand for firewood is greater than the supplies available from the Sukna coupes.

The profit resulting from the sale of firewood in railway cars from the forest is shown by the following figures:—

	Rs.	a.	p.
	per 100 stacked c.ft.		
Cutting and stacking at as. 10 per 60 c.ft. ...	1	0	8
Carting to railway line as. 4 per 60 c.ft. ...	0	6	8
Loading on to cars at Re. 1/8 a car ...	0	3	4
Royalty per 100 c.ft.	1	8	0
Add 10 per cent. wastage and closer tacking ...	0	3	10
Totals ...	3	6	6
Price realised at Rs. 36 per car of 850 c.ft. .	4	3	9
Revenue over and above royalty per 100 c.ft. ...	0	13	3

1923 Season at Sukna.—137,330 c.ft. (stacked) is being sold this year.

	Rs.
Royalty value realised	2,060
Clear profit realised	1,137
Total revenue from fuelwood ...	3,197

Comparison of revenue derived per acre in sal and in softwood forests from sal, box planking and fuelwood by private agency and by Departmental operations.

Item.	Sal forest						Softwood forest.					
	Private agency.			F. Dept.			Private Agency.			F. Dept.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Fuel per 100 c.ft. ...	1	8	0	2	5	3	1	0	0	2	5	3
Fuel per acre ...	60	10	0	97	0	0	36	0	0	84	0	0
Box planking wood per c ft.	0	3	0	0	4	0	0	3	0	0	4	0
Box planking wood per acre.	22	4	0	29	8	0	33	0	0	44	0	0

ITEM.	SAL FOREST.		SOFTWOOD FOREST.	
	Private agency.	F. Dept.	Private Agency.	F. Dept.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Sal trees (3′ girth and over) 3—4′ ...	47 8 0	35 0 0	...	...
4—5′ ...	97 0 0	148 8 0	...	...
5—6′ ...	200 0 0	430 8 0	...	...
6—7′ ...	275 0 0	395 0 0	...	...
Over 7′ ...	42 8 0	147 0 0	...	...
Sal trees per acre ...	662 0 0	1,156 0 0	...	...
Total per Acre...	745 0 0	1,282 8 0	69 0 0	128 0 0

E. O. SHEBBEARE, I.F.S.,
and
G. W. HOULDING,
Forest Engineer.

[*To be continued.*]

FOREST VILLAGES IN BURMA.

The title derives its inspiration from two very interesting articles on forest villages which have appeared recently in the *Indian Forester*, one from Assam in November 1922 and one from Bombay in March 1923. The title is a little misleading however since this article is only concerned with those villages which are situated in the Tharrawaddy Forest Division in Lower Burma. I often wonder what picture the word Tharrawaddy conjures up in the minds of forest men in India. To many it probably conveys nothing except perhaps a memory of the beginning of things when Brandis and Schlich passed this way and left their mark. To certain others who have visited here I know it must convey a vision of bungalows built in the air on vast posts of *pyinkado* and connected by interminable roads made of unfathomable mud. All this sounds rather like self advertisement, but why should we not advertise our Divisions.

This is the age of propaganda, the age of exchange of Notes. There are names of places in India that always rouse my curiosity which has generally to remain unsatisfied. Nilambur—How does the Divisional Officer set about forming and establishing those serried and perfectly even rows of teak of which we hear so much? And what happened to him in the Moplah rebellion? He never told us. Then Kashmir—Is there really an I. F. S. man there and how does one get the job? Does he go to his work by camel or by house-boat? Changa Manga—Ah, I know all about Changa Manga because I have been there. It consists of millions of mosquitoes which don't bite you and funny old lumbering *nilgai* which get chased by your fox terrier. There is also or was a light railway which brings the timber and firewood out to the main line and by which you return in the empty trucks to the bungalow built of stone which is in the heart of the forest. Then I have heard tell of a Division in the C. P. or is it the U. P. where you do your thinnings by motor car and there are curtains in the rest-houses. I may be told that all this information is available in departmental blue books, but I don't like blue books. The *Indian Forester* is a much more interesting place in which to read about these things.

We are not getting on, however, with our forest villages. These villages were started in Tharrawaddy in 1918 for the purpose of providing permanent labour with which to carry out the programme of concentrated regeneration prescribed in the Working Plan for the hill forests. To-day there are seventeen villages distributed over the various felling series that go to make up the regeneration block. The forest villages are of two kinds—the *taungya* village which does the sowing and planting of the forest crop in conjunction with its *taungya* cultivation, and the coolie village which carries out weeding in the young regenerated areas and does various other forest works.

The *taungya* village is situated usually in the middle or on the edge of the compartment which it is going to help to regenerate. The houses are built of bamboo with hardwood posts and thatch roofing. The villagers get their building materials free, and in

return we make them put up substantial houses where they will be comfortable and well protected from the weather. The villagers elect their own headman who has much the same powers as a headman of an ordinary village. He receives a monthly pay from the forest department at the rate of eight annas per household up to a maximum of fifteen rupees. No difficulty is experienced in recruiting *taungya* villagers. The highest ambition of most Burmans in this district is to have a plot of permanent cultivation of their own, but failing that they like to have land on which they can make *taungyas*. This we can offer them and we throw in the additional attractions of exemption from taxes, free forest produce for domestic use and payment for growing our trees for us.

The type of forest with which we are dealing is either moist or dry deciduous forest of mixed species with bamboo. The annual coupe is exploited partly through departmental agency which removes all the teak ; the right to extract the other species is sold by auction to local timber traders who in addition to their bid at the auction pay royalty on the timber extracted. When extraction is completed the coupe still contains numbers of small unmarketable trees and numerous clumps of bamboo. This is where the *taungya* villager comes in. In the February following the completion of exploitation the village clear fells the coupe. The bamboos are felled first and then the trees are felled on top of them. One villager or rather one household can generally tackle four acres successfully. Towards the middle of April the felled débris is set fire to and disappears almost entirely in a fierce conflagration. During the early showers that fall between the date of the fire and sowing time, a good deal of weed growth springs up on the bare surface of the *taungya* and the villager has to make a complete weeding before starting cultivation. During this period he stakes out his area with bamboo stakes at the spacing required. The procedure at this point varies according to the species to be grown. By far the greater portion of the area is regenerated with teak, but in localities which do not produce good teak and which are better suited to other valuable species, these species—generally *pyinkado* (*Xylia dolabriformis*) or *Terminalia tomentosa* in this

Working Circle—are used. In the case of teak, the seed is broad-casted by the villager on a flattish, well drained spot in his *taungya* a few days after the fire so as to form a rough nursery. He then goes on with his staking 6′ × 6′ and his weeding, and by the beginning of June when the rains are setting in, in earnest, he finds that his teak seed has germinated and proceeds to transplant the most vigorous seedlings to the lines. By this means he is sure of getting a strong young plant at each stake. *Pyinkado* and *Terminalia* seeds are delicate and have to be sown direct at stake when the rains have begun but as they germinate very quickly, they soon catch up with the teak seedlings.

The next operation is the sowing of the paddy. This is generally made the occasion of a certain amount of hilarity as the whole village gathers together and does each holding in turn. The young men go in front each armed with a spring bamboo pole about twelve feet long and fitted with an iron grubber. With these instruments they nick little pits with great rapidity in the earth as they go along in line, the pits being about nine inches apart. Behind them come the young ladies with small baskets of paddy from which they drop about a dozen seeds into each pit. They do not cover the seeds with earth as this is done for them by the first shower of rain. Once his paddy is sown the villager is able to sit back and take his ease for a time. From sowing time to harvest he forsakes his house in the village for a small hut erected in his *taungya* and here he spends the rains watching the growth of his paddy, and also we hope, of the tree seedlings. About the middle of January after his paddy has been reaped the young seedlings are counted, and he receives his reward at the rate of eight annas per hundred live plants.

The coolie village is a more difficult problem. Casual labour, in increasingly small quantities nowadays, can be obtained for forest work only at certain times of the year, and during the early part of the rains when the young plantations have to be weeded it is not available at all, as the whole of the local population is then occupied with permanent cultivation. It has therefore been neces-sary to establish at each centre of operation a village for labour only. These coolie villages cannot be given land for cultivation

as this would occupy them at a time when they are required for weeding. We do however allow them a little land round the village and encourage them to make vegetable and fruit gardens thereon. These add a little to the family income and can be attended to by the women and children. During the rains the men are fully occupied with the weeding, filling in of blanks and making of inspection paths in the young regenerated areas. Towards the end of the rains and after all weedings are finished they go on to cleanings and thinnings in the old teak plantations. In the cold weather they are engaged on the girdling of teak and marking of the new coupes, upkeep of roads and paths and repair of boundaries; then they clear the fire lines and in the hot weather they become fire guards. These villagers get the same concessions as *taungya* villagers as regards freedom from taxation. They are collected chiefly from among the poorest of the local inhabitants, but the cost of living is now so high in Burma that in order to induce them to remain in the forests we have to pay up to as much as one rupee a day for rains work.

Without a more or less permanent labour force of this kind it would be impossible nowadays to get through the programme of work. As it is, Burman labour cannot be relied on for earth work, and for road making it has been the custom for several years now to import labour from the Hazaribagh district. The establishment of these coolie villages has solved our labour problem for the time being, but with the ever increasing size of our area under concentrated regeneration it is certainly a problem that will be always with us in Burma.

A. P. DAVIS, I.F.S.

THE STUDY OF A PRIMITIVE COUNTRY AND ITS PEOPLE— BEING A SHORT ACCOUNT OF THE PAWRAS AND BHILS OF THE AKRANI PARGANA, WEST KHANDESH DISTRICT, BOMBAY.

(*Continuation.*)

Marriage.—Pawras and Bhils generally have one wife only, but sometimes 2, and rarely 3, 4 or 5 according to wealth. Remarriage of widows is permitted. Polyandry is unknown.

It is customary for the father of a boy to seek his first wife for him after he has attained maturity. Girls are generally married at the age of 15 to 20. A girl is supposed to be the property of her father and he has every right to dispose of her in marriage to any member of his community, and naturally tries to realise the largest amount he can. A Pawrá father will demand from Rs. 200 to Rs. 300 for his daughter, and a Bhil father from Rs. 25 to Rs. 100. This sum is called *dejo* and the exact amount is settled before a *panch* so as to become binding on all parties. This *dejo* may be paid in one sum or by instalments, and in cash or in kind, *e.g.*, bullocks, etc. Ordinarily the girl is not allowed by her father to go to her husband's house until the major part of the *dejo* is paid, but when a son-in-law is very poor the girl's father may consent to allow him to pay the *dejo* in the form of service. In which case the son-in-law works without wages for his father-in-law for 3 or 4 years and is known as a *khandadia*.

Frequently a time limit is fixed for full payment of the *dejo*. In case of default the father of the girl may, after giving due notice, return the instalment of *dejo* already received and offer his daughter in marriage to a more eligible suitor. Once the girl's father has received full payment, however, the marriage must be completed.

In addition to the payment of *dejo* to the bride's father each family spends from Rs. 20 to Rs. 30 in providing a feast (in which liquor takes a prominent place) to the community at the bride's house, and also pays from Re. 1 to Rs. 3 to the village Patil and 1 or 2 rupees to the village *kamgar*.

In the case of a girl's father being dead, her brother or other nearest male relation takes her father's place in arranging for her marriage.

Should either boy or girl die between their betrothal and marriage the boy's parents have no right to claim a refund of the amount of *dejo* already paid.

If a husband dies leaving wife and children she may remarry, but before doing so she must deliver up all the children of the marriage to the care of their paternal uncle or nearest male rela tive of the deceased who then becomes their lawful guardian and

arranges their upbringing and marriages as he pleases. If any of the children are very young, however, they accompany their mother, but go to their father's house when they no longer specially need their mother's care.

Intermarriage between Pawras and Bhils is contrary to the precepts of custom though many so-called "Bhil-Pawras" now exist. If a Pawra woman marries a Bhil she is outcasted by the Pawras and becomes a Bhil. On the other hand if a Bhil woman marries a Pawra she is taken into the Pawra caste on payment by her husband of a fine inflicted by the *panchayat*.

Divorce.—In the case of a breach between husband and wife the latter must leave all the children of the marriage, if any, whether male or female, and may then return to her father's house. She is not permitted to remarry, however, unless the new husband pays to the former husband the full *dejo* paid by him to her father and also all other expenditure incurred by him on account of the marriage, or, in case of dispute, such amount as may be fixed by the *panchayat*. If the new husband pays the amount fixed then all is finally settled, but if he refuses to pay either wholly or partly a quarrel ensues which may even result in manslaughter or murder. In some cases the *panch* steps in and threatens the new husband with outcasting unless he pays up or returns the wife, and this generally has the desired effect.

If the matter be not settled in *panchayat* and the aggrieved husband has little moral force he frequently appeals to the local Government Officials to compel the new husband to repay the marriage expenses or to return the wife.

Birth and Death Ceremonies. —The birth of a child is the occasion for a few simple ceremonies by the mother and a few of her women friends. The death ceremony is peculiar and much more important. There seems to be no rule as to whether the corpse shall be buried or cremated although children are generally buried.

When a person dies the relatives and friends assemble at the deceased's house, each bringing some spirit with him. The nearest relative also provides liquor for those who attend, including the musicians. When all are assembled some *mowha* spirit is poured into the mouth of the deceased and then all present also partake

of liquor. After this the corpse is conveyed to the burial or cremation ground to the sound of drums and mourning of the people. It is a very common practice to put the deceased's *charpai* (bed) and earthen water pots on top of his grave.

Kiria, or death ceremonies, are often repeated at the end of 7 days, 1 month and 1 year after the death of the deceased. If the family be fairly well-to-do a calf is killed and eaten, and liquor distributed amongst relatives and friends who have been invited to the ceremony.

Religion.—Pawras and Bhils may be classed as animists. They acknowledge large numbers of spirits which are almost all malignant and have to be propitiated with blood offerings. Worship is accompanied by wild dancing. The sacrifices and ceremonies are performed by the men. The women of Akrani may almost be said to have no religion. Possession by spirits is believed in, and witchcraft is much practised. But little importance is attached to regular priests or idols, and it is said that the few red-painted stones representing some deity or other that one sees are merely recent innovations since the appearance of a higher caste Hindu element in Akrani.

They have *budwas* ("medicine-men" and witch-finders) who are supposed to be versed in medicine and remedies, both occult and otherwise, and able to prescribe nostrums for diseases and calamities which have fallen on account of displeasure of the gods. They are also supposed to be able to predict the coming of good and evil events.

Evil spirits are often propitiated in time of sickness or other trouble. Many fields are supposed to be inhabited by evil spirits and before such fields are ploughed goats, fowls and ghee are offered to the spirit. In certain cases fields are considered to be so badly possessed that Pawras and Bhils will not cultivate them.

A supreme, or at least superior Being called *Bhagwan* is occasionally referred to though scarcely worshipped; more often they speak of *Wagdeo* the tiger-god. Other deities worshipped are *Ramdeo*, *Gimdeo*, *Hampdeo*, *Parari sutlideo*, *Matadeo*, and the *Pir* at Dhadgaon. The people swear by *Wagdeo* and *Ramdeo*

but on important occasions they also swear by their sons and daughters. Grain, salt and cow's dung are also used for the same purpose.

In Akrani a number of crimes, including murder, may be traced to witchcraft. Sickness in man and beast is generally attributed to the "evil eye" of some unfortunate woman who is considered to be a witch. Suppose a boy or girl, or even a bullock, becomes sick or suddenly dies then some one is immediately suspected and the *budwa* is consulted. He generally points to the suspected woman, pretending that he does not know her name, and describes her appearance and the locality where she resides in such a way that it can easily be understood whom he means. If any doubt remains another *budwa* is consulted, and sometimes a third. If all *budwas* agree as to the person concerned the women is beaten and persecuted and often tortured in various ways so that she generally has to flee from the village. If the husband also believes that his wife is a witch he sometimes assists in turning her out of the village even if it results in his being left alone with a number of children to look after. More frequently, however, the husband and wife leave the village together.

Frequently witchcraft is taken advantage of by influential men for furthering their own ends. For example, an influential man may covet another man's fields but cannot lawfully obtain them. He may then resort to witchcraft, and after he has assured himself of the support of a few of his friends and the *budwa*, a pretext will be found against the wife of the owner of the field, and she will be declared a witch so that she and her husband must leave the village. Next year it will be found that the man who was instrumental in making the owner leave his field is cultivating it.

There are several forms of ordeal which a woman who is accused of witchcraft may undergo in order to prove her innocence but they are seldom resorted to. Perhaps the most expensive ordeal is for the woman to proceed to Udepur and swear by the Rajah's elephant there. The mahout is first paid Rs. 40 and then the woman is made to stand close up to the elephant, of which she

must be in deadly fear as she can never have seen one before and to say, "If I am guilty let this elephant eat me." One would think that in bygone days a relative of the Rajah's mahout must have advised this remunerative form of ordeal.

Festivals.—The religious festivals celebrated in Akrani comprise *Bhangoria, Holi, Dewali, Dasehra, Dihawa* and *Sitara.* At all of them much *mowha* liquor is drunk and dancing engaged in. Were it not for these attractions the Pawras and Bhils would pay but little attention to them as they are not religiously inclined, but they fear and propitiate evil spirits at all seasons.

Bhangoria is the chief festival of the Akrani Bhils and is held only at Dhadgaon, Dhanaja Budruk and Bhogwada Khurd. It is a moveable festival taking place about the middle of March and is dedicated to their great god *Bhangoria*, whoever he may be. This festival is celebrated at different dates in the 3 villages named, first at Dhadgaon (where the biggest celebration is held), then in Bhogwada Khurd and lastly in Dhanaja Budruk. On each occasion a small fair is held in which outsiders join. On the festival days the people of each village come with a party of dancing men and musicians. These dance in turn, each party trying to excel the other, taking copious draughts of liquor in the intervals. Of late years the District Magistrate has ordered the closing of the local liquor shop during this festival, consequently less quarrels ensue and less heads are broken.

The *Holi* festival occurs at the beginning of the hot season, and in Akrani it is divided into 2 parts, *viz.*, the *Sirkari* (government) *Holi* and the local *Holi*. The *Sirkari Holi* is held in all villages simultaneously, as amongst ordinary Hindus of the plains, and large wood bonfires are burned, while the local *Holi* follows, and is held in different villages on different dates spreading over about 6 weeks, according to the convenience of the various *patils* and villagers. Previous to the festival all the people in a village subscribe so that the *patil* may purchase grain and liquor, and then friends from neighbouring villages are orally invited to attend the celebrations on the day fixed. A big bamboo is set upright in the ground and is surrounded by a bonfire. This is lit on the first night and when the bamboo

burns and falls down the headman of the village cuts off a portion of the bamboo with a sword or axe. Others follow according to age, social position and each cuts off a portion. If they are able to do it in one stroke it is supposed to be a favourable omen for a good harvest. After this dancing commences and continues all night, some of the young men painting their bodies to resemble leopards and wearing a tall headdress of peacook feathers. For several days afterwards they go from house to house dancing and receiving money and liquor from the people.

The *Divali* festival is held in various villages on different dates from November to February. Money is subscribed towards the general expenses as in the case of the *Holi* festival, and in all large Bhil villages a young buffalo is sacrificed to *Waghdeo* and the flesh is then divided up and eaten by the people. The Pawras, who are a higher caste, will not eat the flesh of buffaloes or oxen so they sacrifice a goat instead. At this feast there is less dancing than at *Holi* but much more country spirit is consumed with the result that numerous quarrels ensue, sometimes ending in murder.

The *Dasehra* festival, although of considerable importance amongst Hindus in the plains, is not observed by many in Akrani. It is celebrated in the village of Varfalia where the Pawras sacrifice both a buffalo calf and a goat. The privilege of slaughtering the animals lies with the *patils* of Varfalia and Roshmal Budruk, both close to Dhadgaon. In one year the *patil* of Varfalia slaughters the buffalo calf while the *patil* of Roshmal Budruk slaughters the goat, and in the next year *vice versâ*. In each case the *patil* must try to strike off the head of the sacrificial victim with one swing of the sword. The buffalo flesh is then distributed among the Bhils, and the goat is divided amongst the officiating and subscribing Pawras.

The *Dihawa* festival is held when the maize crop is ripe. On the chosen night, which must fall on Wednesday, Friday or Sunday, the villagers gather at the *patil's* house and sing and dance to the sound of the *dholki* (drum) the whole night. Such effort cannot of course be sustained without copious draughts of country spirit! On the following day they

all go to worship the local *Wagdeo*, and having sacrificed some 4 or 5 fowls and 2 or 3 goats and sprinkled some of the blood on the deity they proceed to cook the flesh under a tree near by. Some of this is offered to the idol and the rest is distributed and eaten. This festival spreads over about a fortnight in different villages.

The *Sitara* festival, dedicated to the goddess Sita is a minor festival in which 16 villages take part. In alternate years a buffalo calf and a goat are sacrificed by means of a sword on the banks of the river Udai below the village of Dhanaja. When a buffalo calf is sacrificed the flesh is distributed among the Bhils present, but when a goat is sacrificed it is divided amongst those who have subscribed towards the cost or who have officiated.

Chickens, goats and buffalo calves are sacrificed not only at festivals but also at the taking of vows or *mantas*. The relatives and friends invited to witness the taking of the vows must of course be supplied with country spirit as well as food.

Fairs.—There are two annual fairs held in Akrani outside Dhadgaon, one being held about the 3rd week in October on Astamba peak (the highest in the Khandesh Satpuras), and the other about the beginning of March at Toranmal. The latter is held in honour of Goraknath, over whose image a shrine is erected, and is connected with the Shivratri festival of the higher caste Hindus of the plains. Apart from the Pawras and Bhils of Akrani many Hindus of the plains, both men and women, come miles through the forest and make the very stiff climb. Some, however, never reach the top, either losing the way or finding the climb too difficult.

All offerings made before the shrine of Goraknath are appropriated by a Sadu or Gosavi of Shahada who comes up from the plains at the time of the fair. At other times the shrine is attended by a local Bhil.

Goraknath is supposed to be able to remove barrenness from women provided they fulfil their vows to him. The husband and wife are made to stand before the shrine after bathing in the lake close by; the Gosavi then recites certain prayers which the pair repeat after him, and at the conclusion

both hushand and wife have to lift up a small stone lying before the idol. If they are able to lift the stone (and it appears to be simple enough) it is held to be a sign that the god is favourably inclined towards them and that they will afterwards be blessed with children.

H. W. STARTE, I.F.S.

[*To be continued.*]

OBSERVATIONS ON THE LIFE-CYCLES OF SOUTH INDIAN LAC INSECTS.

Lac insects proper are those that produce the commercial product known as stick-lac. There are other insects which are incapable of producing this raw materal. The former class of insects are to be known by a more connotative name *Lakshadia* and the name *Tachardia* should be retained for the other genus comprising the pseudo-lac insects as these also happen to be greater in number—both these genera being included in the sub-family *Tachardinæ*.

In a paper entitled, "Classification of lac insects from a physiological standpoint," I have explained at length the reasons for such a separation. I have also shown that the insect which grows on *Butea frondosa* in most parts of India called *Tachardia lacca* = *Lakshadia indica* is different from lac insects found in the South.

Possibly there are the following species of insects found elsewhere in India. *Lakshadia nagoliensis* on *Schleichera trijuga*, *L. chinensis* found in Assam and in Indo-China, *L. sindica* on *Acacia arabica* in Sind.

In Mysore we have two insects of this class. One of them occurs on various species of *Ficus*. It was found in the Botanical Gardens at Madras on *Ficus Benjamina*; in Mysore State it usually occurs on *F. mysorensis*, in Hyderabad State it thrives on *F. bengalensis* and to a lesser extent on *Ficus religiosa*; in Bombay it was found on *Albizzia Lebbek*. It is not the *T. ficii* described by Mr. Green in 1903 from *F. bengalensis* in Behar. Some of the type material kindly sent by him, showed a lemon yellow

colour and his insect may possibly be identical with *Lakshadia indica.* Specimens of lac collected by me in the south of India are darker, the colour ranges from chestnut to ruby-red.

This insect is not restricted in the choice of its host plant which perhaps explains its wide distribution. For these reasons it has been called *Lakshadia communis.*

All the insects named so far are supposed to be two-brooded. The insect which is responsible for the lac industry of Mysore has 3 life-cycles a year.

It has been found new to science and has been named *Lakshadia mysorensis.* It has only one host plant on which it thrives naturally, *viz.*, *Shorea Talura* or in Kanarese, *jalari* which is *the* lac tree of Mysore. The nearest locality where lac is commercially propagated is Dorasanipalyam, some 12 miles south of Bangalore and the following records refer to it :—

Lakshadia mysorensis.

1917—November 6th.—Larval swarming observed by Mr. T. V. Subramanyam, Assistant Entomologist, Department of Agriculture in Mysore. This brood was inoculated on a *Ficus* species and on

1918—February 4th.—Wingless males were observed emerging.

1918—April 16th.—Larval swarming.

The following records were taken by me :—

I

1919—December 21st to February 5th, 1920.—Larval swarming continued.

1920—March 10th.—Wingless males were observed and a few winged ones also.

II

1920—April 29th to June 18.—Larval swarming continued.

Emergence of males in this season was not recorded.

III

1920—August 26th to September 22nd.—Larval swarming.

1920—October 15th to November 6th.—Emergence of wingless males.

I

1921—January 24th to February 21st—Larval swarming.

On February 5th the lac contractor started his operations of collection. Trees were seen in flowers on 5th February.

1921—March 29th.—Emergence of wingless males.

II

1921—May 19th to 29th.—Larval swarming was recorded only for this period.

On May 29th the contractor started his operations.

1921—July 10th to 20th.—Wingless males observed emerging during this time.

III

1921—September 23rd to October 23rd.—Larval swarming.

September 27th.—Collection of lac by the contractor started.

1921—December 7th.—Wingless males emerged.

I

1922—February 14th.—Larval swarming noticed. Further dates not recorded.

1922—April 16th to May 5th.—Wingless males emerged.

II

1922—June 17th to July 23.—Larval swarming.

1922—August 7th to August 19th.—Wingless males emerged.

III

1922—October 13th to November 19th.—Larval swarming.

On November 5th profuse swarming started and lasted for about 10 days.

1922—December 25th to January 7th, 1923.—Wingless males emerged.

I

1923—March 23rd to April 10th.—Larval swarming.

1923—April 5th.—Profuse swarming.

1923—May 11th.—Emergence of wingless males.

May 20th.—Emergence of winged males, a few only.

It will be seen that there are not exactly 3 generations in one calendar year. This accounts for the opinion among lac-lessees in Mysore that there are 3 crops in two years, which of course is erring to their advantage.

There appear to be 14 crops in 5 years and the average crop seems to take 4 months and 10 days. Mr. M. Srinivasayya has made a most important discovery that the larval swarming is associated with lunar periodicity and the dark half of the month corresponds with the period of intense larval swarming. In this light there appear to be 3 crops in 13 lunar months. Sudden showers of rains bring about an earlier swarming and late rains predetermine deferred larval swarming. It is possible that the rains themselves may be indirectly influenced by the phases of the moon, in which case it would ultimately become a question of astronomy rather than the meteorology to predict the time of larval swarming. The crop which matures during the rains is the best. The one immediately following it takes the longest duration, and is also poorest in quantity.

The third crop or the one which precedes the rains is the shortest and is more allied to the second crop.

The quantity of lac collected in 3 different periods coincides with the difference in the amount of rainfall and is therefore directly proportional to it. The reason for such a phenomenon is explained in the following manner. The insects harbour inter-cellular micro-organisms which look like yeasts but which are the *conidia* of a fungus, possibly of the genus *Monilia*. The fungus rather than the insect loves moisture and this accounts why the greatest yield is associated with the rains. If time were a factor the best crop ought to have been when the period of growth was the longest, this happens to be the driest period and naturally the fungus is not in a state of vigour. It may be said that the cold

retards the growth of the insect and the low temperature therefore is responsible for the longest period of growth and also for the poverty of the crop.

Considering temperature as the main factor, it would follow that the shortest time would be taken by the generation growing in the hottest part of the year. Although this is true, the yield of crop is not the best at this time. In fact all previous writers on lac divide their crops of lac into cold weather crop which is said to be good in some localities and hot weather crop which is said to be inferior. Heat and not cold has been known as deterrent on the whole rather than beneficial although they have noted that the period of growth is shortest when the average temperature is higher. If we grant moisture as the primary and heat as the secondary factor, we can explain how the best combination of both gives best results during the monsoons, and the defficiency in both the poorest yield during the coldest season which really means the season of least rainfall.

The generation of lac which matures during the monsoons in north India, grows in a season when both these factors are ideally combined. The different contradictory remarks with regard to the best crop being the Baisakhi or the Katki in different localities in India, may be explained in the light of the above explanations.

In Mysore lac also occurs on *Ficus mysorensis* and its insect has been named *Lakshadia communis*. It is a two-brooded insect as the following records will show :—

1916—December—January.—*L. communis* larval swarming on *Albizzia Lebbek* in Bombay.

1920—November 6th.—A parcel of lac which was sent to me from Nirmal in Hyderabad, derived from *Butea frondosa*, the insect being *Lakshadia indica* = *Tachardia lacca* showed larval swarming. This will show the similarity of *L. communis* in Bangalore with this insect up north rather than with the local insect *L. mysorensis.*

1921—March 5th.—On *Ficus Benjamina* in Lalbag Gardens Bangalore, winged males emerged. A good many cells were found empty showing emergence had started some fortnight ago.

1921—July 7th.—On *Nephelium Litchi* in Lalbag, wingless males were observed. Emergence of wingless forms alone continued till July 20th.

1921—September 29th.—Larval swarming occurred on the above *litchi* tree.

1921—October 15th.—Larval swarming on *Ficus mysorensis* in Lalbag.

1921—October 28th.—Larval swarming on another *F. mysorensis* tree in Lalbag.

1921—November 13th.—Swarming on a third *F. mysorensis* tree.

1921—December 6th.—Larval swarming on *Pithecolobium Saman* in St. Mark's Road. Bangalore.

1921—November 15th.—Emergence of winged males from encrustation on *Acacia concinna*, growing near Yaswanthpur village just outside the northern limits of Bangalore Municipality.

1921—December 10th to 1922—January 2nd.—Winged males emerged from encrustation on the ordinary fig tree, *Ficus Carica* in the estates of the Indian Institute of Science which is also near Yaswanthpur.

1922—February 10th.—Winged males on *litchi* tree in Lalbag possibly from the larvæ that swarmed on September 29th, 1921.

1922—March 9th.—Winged males from encrustations on *litchi* in Lalbag, which was inoculated on November 13th, 1921, with brood lac from *F. mysorensis*.

1922—May 16th to 27th.—Larval swarming from brood lac on *F. mysorensis* in Lalbag.

1922—August 12th to 28th—Wingless males emerged from encrustations on *F. mysorensis* outside Lalbag.

1922—September 14th.—Emergence of wingless males on *Anona squamosa* near Lalbag.

1922—September 18th.—Emergence of wingless males on *F. mysorensis* outside Lalbag.

1922—October 11th.—Larval swarming on *F. mysorensis* outside Lalbag.

1922—November 4th.—Profuse larval swarming from brood lac derived from *F. mysorensis*, *Guazuma tomentosa* and *Anona*

squamosa collected from all over Bangalore. On November 19th the intensity of swarming decreased.

1922—December 12th.—Larval swarming from brood lac collected a few days ago from *Anona squamosa.*

1923—March 17th to 31st.—Winged males emerged from encrustation on a creeper variety of rose, possibly Maréschal Niel growing in the bungalow of Dr. Coleman, Director of Agriculture in Msyore, situated in Ali Asgar Road, Bangalore.

L. communis has two life-cycles a year. One generation lasts from November to June both being included, the other begins and ends with the monsoons from June to October. The rainy season generation gives rise to wingless males during August, the drier period generation to winged males which emerge during February to March. The ratio of males to females during the dry season is very great. From circumstantial evidence it appears that even parthogenetic female cells occur during the dry weather. These are somewhat ornamentally sculptured, resembling a crown in shape.

The crop of lac during the dry period is very poor due not to any direct and injurious influence of the weather but to the poor number of females and the unhealthy excess of males, the same insect however does give sufficient quantity of lac on *F. bengalensis* in Hyderabad during June. If the males are not so numerous in this case it is probably due to the lesser raintall during August to October in Hyderabad as compared with Bangalore. Even in Hyderabad this insect is not artificially cultivated, and when lac is seen in any appreciable quantity on *F. bengalensis* or on *F. religiosa* it is merely collected. There again we do get unhealthy excess of males but not so regularly as is the case in Mysore. During the rains lac is very heavily attacked with *Eublemma amabilis* and this may be another reason why it is not collected in Mysore.

Lac insects proper produce an encrustation which melts and dissolves in alcohol in the manner gum arabic dissolves in water and leaves very little alcohol insoluble residue and whatever it does leave is wax, and this soon dissolves, on the alcohol being warmed. The encrustation breaks with a crystalline fracture and is brittle

like glass. The insects producing it have intercellular symbiotic yeast-like organisms which are possibly *conidia* of the fungus *Monilia*. Both winged and wingless forms of males are known. These alone must be called *Lakshadia* or lac insects proper. The pseudo lac insects must be separated from these and for them the old name *Tachardia* may be retained. The pseudo-lac insects are not spheriodical but distinctly flat specially on the ventral side. Their body-outile is lobed and not circular. They produce a leathery or parchment-like cell which is not fragile and may be cut with a sharp razor without breaking into pieces. It does not melt in the sense shellac does. It is not possible to draw a fine thread with the point of a hot needle. It leaves a large alcohol insoluble residue which is not wax and which does not dissolve in warm alcohol. The manner in which pseudo lac dissolves in alchol may be compared to gum tragacanth dissolving in water wherein it swells before it dissolves. These insects do not give rise to honey dew, they do not contain yeast-like symbiotic organisms. Only winged forms of males occur.

There are two pseudo-lac insects in Bangalore. One is *Tachardia minuta* of Dr. Morrison as my specimens were identified by him and the other is *Tachardia silvestri*. The former grows round about Bangalore most frequently on *Pongamia glabra* and in addition to it on *Michelia Champaca*. *T. silvestri* grows most commonly on *Ixora parviflora* and also on *Hamelia patens*. Both these insects have two hosts common between them, *Guazuma tomentosa* and *Santalum album*. *T. minuta* produces red brown encrustation with a distinct purplish hue not unlike the appearance of the fruits of *Eugenia Jambolana*. *T. silvestri* is more orange and has not bluish tint about it. In earlier stages it is bright golden yellow. Blood smear of *T. silvestri* reveals the presence of chains of symbiotic bacteria and this easily distinguishes it from the other. *T. minuta* has only one form of female cells. *T. silvestri* has two, one looks like a smaller form of *T. minuta*, the other is flatter and more rough in appearance. The latter I imagine represents parthogenetic form.

An insect belonging to the genus *Tachardia* or pseudo-lac insects was sent to me from Travancore by Mr. Naranayya, the

shellac expert of the State. It grows near about Aramboly on *Acacia Sundra.*

All these pseudo-cal insects do not seem to have a fixed period for larval swarming and for the emergence of males. *T. minuta* from *Pongamia glabra* was inoculated on *Michelia Champaca* which had no sign of any encrustation on it. The inoculation was done on 15th October 1921 and the next larval swarming was observed on 12th August 1922 and thus the life-cycle occupied 10 months. The *Pongamia* tree which had supplied brood for this experiment also showed profuse larval swarming about this time and therefore there was no possibility of a deferred larval swarming on *M. Champaca.* This species of trees had been previously observed attacked with *T. minuta.*

Travancore insects were sent to me in parcels and the following dates refer to them :—

1920—December 10th.—Larval swarming noticed when the parcel was opened.

1921—March 6th.—Larval swarming noticed and it continued till 24th.

1921—May 31st.—Larval swarming noticed and it continued till 14th June.

On 5th June winged males emerged, and the emergence continued for a week.

1921—October 11th.—Larval swarming continued till 26th October.

Winged males emerged throughout this period.

1921—December 23rd.—Larval swarming continued till 1922, January 7th.

A few winged males were seen on the last date.

The following observations refer to *Tachardia minuta* :—

1921—June 28th.—Larval swarming on *Guazuma tomentosa* in Lalbag gardens.

1921—September 20th.—Larval swarming on the same tree.

1921—October 10th.—Larval swarming on *Pongamia glabra* outside Lalbag.

1921—October 15th.—Brood lac from the above tree was introduced on *Michelia Champaca* growing in the estates of Indian Institute of Science.

1921—October 26th.—Larval swarming was most profuse on *Pongamia* referred above.

1921—December 24th.—Larval swarming on *Pongamia glabra* on the District Road near the village Dursanipalyam, a locality already referred to.

1922—August 12th.—Larval swarming on *M. Champaca* in the Indian Institute of Science and on *Pongamia glabra* outside Lalbag. Please refer to October 15th.

1922—October 10th.—Sandal-wood trees on the Serpentine Road leading to the Public Offices in Bangalore were found attacked with this insect. A few larvæ had completed their first stage. Most of them had not moulted yet. On 24th October larvæ on *Pongamia glabra* outside Lalbag showed similar stage of development. From this I conclude that the larval swarming must have occurred at the end of July.

1923—January 12th.—Winged males emerged on Sandal-wood trees and also on *Pongamia glabra.*

1923—January 20th.—Larval swarming on *Guazuma tomentosa* growing in the estates of Indian Institute of Science. This tree was not artifically inocculated. Many larvæ had already settled on young shoots but the swarming continued till February 6th.

1923—April 28th.—Winged males had all emerged from the above.

1923—May 20th.—Larval swarming on Sandal-wood trees on the Serpentine Road.

The following records refer to *Tachardia silvestri* :—

1922—February 22nd.—Larval swarming on a Sandal-wood tree in St. Mark's Road, Bangalore.

1922—August 23rd.—Larval swarming on the above tree.

1922—September 14th.—Profuse larval swarming on the same tree.

1922.—December 26th.—Larval swarming on the same tree.

1923—February 23rd.—Winged males emerged from the encrustations on the same tree.

1923—April 23rd.—Larval swarming on the same.

1923—May 20th.—Larval swarming on the same.

1921—December 10th.—Larval swarming on *Ixora parviflora* in Lalbag.

1922—February 22nd.—Larval swarming on *Ixora parviflora* in Lalbag.

1922—December 26th.—Larval swarming on *Ixora parviflora* in Lalbag.

1923—April 23rd.—Larval swarming on *Ixora parviflora* in Lalbag.

1922—December 24th.—Winged males from encrustation on *Ficus Benjamina* in Lalbag.

1923—January 22nd.—Winged males on *Guazuma tomentosa* in Lalbag.

1923—January 25th.—Larval swarming on the same tree which continued till February 6th.

S. MAHDIHASSAN.

FOREST FIRES IN THE ESTEREL.

The news recently published in the *Pioneer* regarding the extensive forest fires in the Esterel Reserve are melancholy reading for any one who knows the country which is one of the prettiest parts of the Riviera. The writer visited this forest twice, once in 1907 and again in 1920 and was very courteously received by the French Forest Officers on both occasions. Forest fires are no new thing in the Esterel and the whole reserve dates from different fires which have swept through it with disastrous effect at various times.

This is hardly to be wondered at when one realises that the soil is poor and rocky, the rainfall very light (20″ to 25″ so far as I can remember) and the growing stock consists almost entirely of highly inflammable conifers chiefly maritime pine with an undergrowth of even more inflammable shrubs similar to the famous Corsican Maquis. There was at one time a good deal of chêne liège (cork oak) but this had been replaced by conifers which were found more profitable.

In 1907 the management had reached a very high degree of perfection and the system of fire protection was better and more elaborate than anything I have seen elsewhere.

There was a lookout post on top of a high hill in the middle of the reserve which was connected with the Garde Generale's office in Frejus and with all the Forest Guards' quarters by telephone.

The whole forest was cut up into small sections by a most elaborate system of fire-lines along ridges, valleys and roads and the undergrowth was systematically removed from various blocks in rotation.

These operations known as "Débroussaillements" were both troublesome and expensive but were found to be the only effective method of dealing with forest fires as it enabled the forest officers to counter-fire and isolate a fire occuring in any of the small blocks in which the forest was divided.

The picture in 1920 was very different as nearly all the staff most of whom had served in the army as officers or non-commission officers were called up and the whole of the elaborate system of fire protection had been practically abandoned with the result that the greater part of the forest was destroyed during and immediately after the war and apparently all that escaped them has been destroyed now.

When I last visited the forest it was difficult to see very much as the fires had been followed by floods which had washed away the roads in many places but the D. F. O. (Garde Generale) very kindly offered to take me out to see the utilisation operations arranged to remove the dead trees left standing after the fire. The Forest Department had built a small jetty for steamers on the coast and had constructed a light tramway into the forest and at one time employed 3,000 German prisoners in cutting the dead trees, loading them on the tramway and shipping them off to Wales as pitprops. When I was there in October 1920 most of the Germans were gone, though I saw a few who had been sentenced to various additional terms of imprisonment, and two of them upset a timber cart in front of us. I was driving in a small mule cart rather like a high dog cart and the old Head Guard who was driving was not a very expert whip.

The delay caused by the timber cart apparently got on the mules nerves and he made up his mind to get home as soon as possible with the result that we ended our tour in a somewhat undignified manner as we were both thrown out and I landed on top of the unfortunate Head Guard who was knocked out of time. The cause of the recent fires is not mentioned in any of the papers I have seen but it seems probable that the French Government have been too busy with their adventure in the rules to devote the usual attention to home affairs. We have not heard of any Geddes Committee in France as the French seem more bent on extracting the last ton of marks out of Germany than in raising funds by retrenchment at home, but it seems possible that they have been cutting down their expenditure on protection, as a fire such as that recently described in the *Pioneer* would have been practically impossible in 1907.

It is a pity that more Indian Foresters do not visit the Forests in the south of France as conditions are far more similar to those of an ordinary Indian Forest Division, than in the North of France, Germany or Switzerland, and it might be well worth for students to visit the "Esterel" even now to study the cause and effects of forest fires. Fortunately forest fires do not do as much damage in the deciduous broadleaved forests of the plains of India as in coniferous forests, but there is a dangerous tendency nowadays to look upon early burning as an universal panacea and underrate the importance of fire protection.

G. M. TOWNSHEND, I.F.S.

REVIEWS AND EXTRACTS.

BURMA FOREST ADMINISTRATION REPORT, 1921-22.

It is disappointing that this report, the last to discuss the work of the Department in Burma under the old regimé, should have been issued without the usual Government Review. Presumably the Government of Burma was too much occupied with the Reforms to be able to consider it before the 1st January 1923, from which date forests in Burma became a transferred subject,

and passed under the control of a Minister responsible to the Legislative Council. The Minister has shown by his public utterances since his appointment that he is fully alive to the importance of the forests of Burma and to the needs of the Department which administers them; and we may confidently expect that the progress which the report discloses will continue unchecked.

The report appears this year in a new form. In the first place the arrangement of chapters and sections laid down in the Code has been altered to a more logical and convenient sequence. In the second place the Circle Reports have been printed separately, and the publication now before us is a summary and a review of those reports compiled by the Chief Conservator of Forests. Formerly the reader had to find his way among a mass of details and extracts from Circle Reports of varying degrees of interest and importance: he is now presented with a clear, comprehensive, and not too detailed account of the year's work. We commend this example to the attention of other Provinces containing many Circles.

Since the first essential to regular forest administration is a staff wherewith to carry it out, the report appropriately opens with the chapter on establishment. From this we find that at the end of 1922 there were 44 posts vacant in the Imperial Service cadré of 110, and 64 in the Provincial Service cadré of 109. The remarks which follow to the effect that the shortage of gazetted officers hinders progress in all direction, will probably not be questioned by any one, even though he be not actually acquainted with the vast and undeveloped areas of the Burma forests. However, since the report was written ten recruits have joined in the Imperial Service and more are expected this year while for the Provincial Service the School of Forestry at the Rangoon University, alluded to in the report as a hope for the future, is now an accomplished fact, having been opened in May 1923 with every promise of success.

Shortage of trained Rangers is another handicap, and to remedy this we must look to the Burma Forest School at Pyinmana, the photograph of which will perhaps arouse some envy

in the minds of officers connected with older educational institutions. This excellent school has been enlarged, and we gather from the report that it can now accommodate annually some 30 to 40 students in the English class, and 25 in the Vernacular class.

The remarks on the cordial relations between District and Forest Officers are pleasant reading. The value of such relations to the Department is very great. In particular the assistance of District Officers in explaining to the people the aims of Forest Policy is in present circumstances of the highest importance.

Paragraph 19 of the report refers to a table which purports to show how much of the present unclassed forests may possibly be fit for reservation in the future ; but the press has apparently forgotten to insert the table. This is unfortunate, for the figures would have been interesting. The area of unclassed forest in Burma is very large, 114,622 square miles as shown in Form 7; and it is certain that an appreciable proportion of it could and should be reserved. It appears however from the report that the question of a general policy of reservation, which has been a subject of discussion for the last four years, has not yet advanced to a decision. This is a matter to which the Minister might well turn his attention. Reservation will not become easier by lapse of time, rather the reverse. Another matter for the Minister is the speeding-up of Settlement proceedings. There is no doubt that the present procedure might be simplified with advantage, but the delays which now occur are not all a necessary feature of the procedure, and steps might be taken to eliminate the unnecessary ones. Further information regarding the line taken in disposing of claims to *taungya* cultivation will be awaited with interest. It should be a cardinal principle to get the *taungya* cutters on the side of the Department as far as possible. The best solution appears to be to induce them to accept the status of forest villagers in which case they will be available for regeneration work.

Survey and Working Plans are both under the control of the Working Plans Conservator. That officer remarks with truth that every division in Burma requires examination from the working plan standpoint ; and the remark gives some indication of the

amount of work which lies before the branch, and which it is hoped will be taken in hand methodically when the strengthening of the gazetted staff makes this practicable. Nearly all of the existing plans are for the extraction of teak only on the so-called Selection System. The adoption of concentrated regeneration and the increasing utilisation of species other than teak make a change of system imperative in the more accessible forests. During the year the two regular working plan parties available worked on the revision of the plans of the Zigôn and South Toungoo Divisions, for which the plans had expired, or were about to do so. In addition to this a good deal of work was done by several Divisional Officers in the direction of combining the various plans in their divisions into a divisional plan, and at the same time introducting as far as possible the changes of system required by the altered conditions. There is no doubt that the policy of a single plan for a whole division is sound. The control of the existing plans for teak was altered during the year by substituting a yield fixed by the basal area for the original yield prescribed by number of trees, which latter is obviously impossible in any system of concentrated working. The basal area yield is a makeshift until research makes the adoption of a volume yield possible. It is whispered that the basal area control was not received with any great favour by some Divisional Officers, but then it is notorious that most Divisional Officers detest control forms of any description.

Every forester will rejoice to see that research looms so large in this report, occupying as it does no less than 21 out of a total of 55 pages of letterpress. Of the 21, Silviculture accounts for 17, and this is no bad criterion of the importance to Burma of that branch of forestry which is really the basis of all regular forest management. It is impossible in the short space of this review to give an adequate idea of all of Mr. Blanford's activities ; and indeed the pages in the report are only extracts from his original report, which has been printed separately in extenso. All branches of silvicultural research, both experimental and statistical, are touched upon ; but for want of sufficient staff the latter branch did not receive as much attention as could have been wished. It is obvious that one officer cannot do everything, even

though assisted by a recently joined Imperial Assistant; and we may hope that future reports will show that the authorities realise the importance of the Silviculturist's branch and are prepared to give it an adequate staff.

A large part of the report is devoted to plantations, mostly on the *taungya* system, and mostly of teak, except in Tharawaddy, where various other species were experimented with. As regards teak *taungyas*, two facts appear to be definitely established: first that a dense stock must be obtained in the first year, otherwise subsequent weeding becomes prohibitive, even if labour is available to do it; and second, that dense young teak plantations must be thinned early, not later than the sixth year, otherwise their development is seriously affected. A sufficiently dense stock can ordinarily be obtained by planting $6' \times 6'$ but experiments are in progress in the direction of wider spacing, with broadcasting of subsidiary species in between. In our opinion it is doubtful whether these will give better results than the $6' \times 6'$ planting, or will even be cheaper in the long run. Apropos of other species it is interesting to note that with the exception of *yemane (Gmelina arborea)*, which grows like a weed, teak is the easiest and cheapest species to deal with.

Mr. Blanford has given an interesting calculation of the financial aspect of teak plantations. His conclusion—presumably based on present prices and rates of labour—is that the plantations now being made will at the end of a rotation of 80 years have yielded compound interest at the rate of just under 6 per cent. This is an investment that any Government may well be satisfied with. Incidentally it is stated that the plantations made during the year under report alone will, at the end of 80 years, give a final yield valued at over a crore of rupees.

The report of the Utilisation Conservator has also been printed separately, but a resumé of it is given in the report under review. Further information on the decision of Government as to the organisation of timber research will be awaited with interest. It appears that seasoning experiments, both in sheds and in kilns, are to be continued and developed; while timber-testing is to be handed over to the Dehra Dun Institute. This is undoubtedly sound, for the Dehra testing laboratories are now fully equipped,

and there is no object in duplicating work of this kind. The same may be said of Wood Technology. On the other hand Wood Preservation is a subject which might well be taken up in Burma in view of the large number of species which might be suitable for railway sleepers and construction work if treated antiseptically. The experimental plant at Dehra Dun is likely to be fully employed for several years to come on Indian species which are not necessarily of importance to Burma.

The remarks on the paper pulp industry are interesting, and in some respects amusing. The only mill in the province, that of Messrs. Jamal Bros., was burnt down just as it was approaching completion. Of four other concessions for bamboos given to various firms, one appears to have been abandoned. This was located in the wrong place in the first instance, a place where the demands of the firm could not be satisfactorily adjusted with those of local bamboo traders, which should naturally receive prior consideration. The other three, in Arakan and Tavoy, are located in ideal areas, where water transport facilities are excellent, and the bamboos are practically a waste product. In spite of these advantages none of the concessionaries have started work, though they have obtained extensions of their options. This is an interesting comment on the accusations which have been made against the Government of Burma of stifling a great industry which was ripe for development. It must always be remembered, in connection with pulp concessions in Burma, that the bamboo is a necessity of life to the Burman ; and therefore pulp concessions are proper only in places where the local demand is insignificant in comparison.

The bulk of forest offences in Burma relate to the illicit removal of timber and firewood. These are being countered in the right way, *viz.*, by drawing up schemes of exploitation so as to place forest produce within the reach of all who want it as far as possible, and so reduce the temptation to theft. Illicit grazing was responsible for only 257 cases out of 6,800. The Burman does not keep hordes of useless cattle as the Indian does ; and in most divisions in Burma the grazing problem as it presents itself in India practically does not exist. In some places however cattle and goat breeding by Indian immigrants is increasing, and this

will have to be watched. On the whole the protection of forests from man and from cattle is nothing like the difficulty in Burma that it is in India ; and the Divisional Officer in Burma can hold himself fortunate in that respect. It is not the Burman is more law-abiding than the Indian ; but the population is much smaller in comparison with the forest resources of the country. This makes it possible for the Department in Burma to employ a comparatively smaller staff of lower subordinates than in most Provinces of India ; though the report shows that they are no more reliable than elsewhere.

Fire protection has been abandoned in practically all the natural forests, and is now only applied to young plantations and areas under regeneration. This represents a violent reaction from the policy of ten years ago, and it may possibly have been carried too far ; but it has sound arguments to support it in the case of the valuable teak forests. Fire is a bad master but a good servant ; and the experiments which are being made as regards early burning will be watched with interest. Mr. Blanford points out, as an example of the uses of fire protection in special cases, that it is essential for the regeneration of the hygrophilous *Dipterocarps*.

Game protection was as usual a farce. Forest Officers, with no effective public opinion to support them, can do practically nothing to enforce the rules.

Roads and buildings are a sore point with Forest Officers in Burma. Whenever money has had to be cut out of the budget sub-heads A VIIa and A VIIb have seldom escaped ; indeed they often provided the bulk of the savings. The report contains the usual complaint on that score ; but still progress has been made. Forest Officers in Rangoon in particular should be grateful for the eight wooden houses built there. These are perhaps not quite so palatial as some people might wish, but they have at least realised the acute shortage of houses.

It is notable that a considerable proportion of the money spent was on houses for subordinates. This is as it should be. Decent quarters add much to the contentment of the staff. As regards roads, the great need now is for cart roads to facilitate the extraction of non-floating timbers from the forests. As long

as such roads do not exist the forest wealth of the country cannot be developed. It is probably not realised by many people outside Burma that of all the important timber of that country teak is the only one which will float. New five-year programmes, both for road and buildings, have now been drawn up ; and we believe that since the report was written more satisfactory arrangements have been made for financing development in this direction.

The river training works in Prome and Tharrawaddy continue to fulfil their functions with admirable success. These works are well worth a visit by any one interested in the extraction of timber by water. The reconstruction of the big Ahlone depôt at Rangoon was sanctioned during the year. The plans provide for three large tanks into which timber is floated from the river at high tide, sorted, laid dry for inspection, sold, and floated out again. This should be a great improvement on the old muddy depôt, where a certain amount of confusion was not unknown.

Chapter VII, Exploitation and Commercial Development, is full of interest, but it is impossible here to touch on more than a few points. Little information is yet available as to the results of the so-called clear fellings of species other than teak. These amount really to a heavy improvement felling in favour of what is left, including the teak ; and if the latter species is present in sufficient quantity it may afford a sufficient stock to obviate the necessity for complete regeneration of the felled areas. Such regeneration cannot at present keep pace with the fellings ; but in the meanwhile it is worth the risk of depleting some areas of valuable species for the sake of the information which these operations will bring.

Departmental work was continued in the Myitmaka Extraction Division with the usual efficiency. The completeness with which utilisation is carried out by Mr. Cheyne and his trained staff may be judged from the fact that whereas the average volume of log extracted by the big teak lessees varied between 42·9 and 60 c.ft., the corresponding figure for the Myitmaka Division was 30·7 c.ft. It is suggested in the report that in the extraction of smaller and inferior timber the economic limit may have been passed. This may be so, but it depends on the interpretation of the word "economic." The policy of the lessees is to extract

as far as possible only high class material. This means a limited market and high prices. The policy of the Forest Department should be to extend the use of teak rather than to limit it, and to ensure that any one who wants teak should be able to get it of a quality and at a price suitable to his means. It is a fact that in some divisions timber which has been left behind as unmarketable by lessees is afterwards extracted by petty contractors on Government account and sold at remunerative rates. There has been a tendency in the past to ignore, if not to discourage, the local market for teak. This seems to be a mistake.

The shipment of teak and other timbers to Messrs. Howard Bros. & Co., for sale in England was continued. It would have been interesting if figures could have been given to show the increased profits obtained by this arrangement over Rangoon sales. We gather that such figures may be expected in future reports.

The private agencies working on timber extraction in Burma fall naturally into four classes: (i) the big lessees, both for teak and other species, whose agreements ordinarily run to not less than 15 years; (ii) the smaller lessee with a five or six year agreement; (iii) the one-year purchase contractor who buys his pre-marked compartment by auction or tender and (iv) the licensee, who gets his pre-paid license from the divisional office and then fells up to the limit entered in it, generally choosing his own trees. This last-named vicious system applies almost entirely to the unclassed forests, and as these are reduced by reservation, conversion to cultivation, and sheer destruction we may hope that it will eventually die a natural death, and the present licensees will by combination and association graduate into the class of purchase contractors. Timber is a big and profitable business in Burma. There are 164 sawmills in the country, and more building and it is not easy to keep them all supplied. In some places, for instance, in the Pyinmana Division and the neighbourhood of Moulmein, the demand degenerates into a wild scramble for such trees as are put up for sale. In such places plans are urgently required, and are being prepared, to open up all the accessible forests so as to supply the demand to the fullest extent possible

It seems probable that some of the existing mills, which depend mostly on the unclassed forests now rapidly approaching exhaustion, will have to move elsewhere.

The total value of minor products removed by purchasers was Rs. 9,31,770. The largest item was on account of lac, most of which comes from unclassed forests, and pays royalty in the form of an export duty collected at the ports by the Customs Department. Next come bamboos, and the revenue of Rs. 2,92,297 under this head may seem small for a country like Burma. It must be remembered however that bamboos are a necessity to the Burman, and the royalty rates are therefore kept very low. The details in Form 20 are interesting ; and items such as bats' guano and edible birds' nests will arouse envy in other Provinces which are without these articles of use or luxury.

The figures for the value of produce given away free or at privileged rates to rightholders and others are interesting. The total for the year was Rs. 6,43,573. The area of forest in Burma is 144,708 square miles. The United Provinces, with 7,444 square miles of forest gave away Rs. 5,91,023 worth of forest produce in 1921-22 ; and the Punjab, with 6,615 square miles, gave away over Rs. 30 lakhs' worth. The people in Burma are as a matter of fact liberally treated in the matter of rights and concessions ; and these figures show what has been stated elsewhere, that the pressure of the population on the forests is nothing like what it is in other localities.

One would not expect Burma to be a timber importing country, and as a matter of fact it is not, the only imports of any consequence being teak from Siam and the Shan States. This is only an import because the rivers down which it is floated happen to run through Burma in the lower part of their course. Of timber imported for special purposes the report mentions sucker-rods for oil wells. It has now been proved at Dehra Dun that at least two Burma timbers are quite suitable for the purpose, so we may expect this item to disappear from the import list before long. The export for the year amounted to 183,668 tons of teak and 32,681 tons of other species.

The bulk of this timber was shipped by the big timber firms to India. On Government account, 7,585 tons of teak and 2,722 tons

of other species were sent to Messrs. Howard Bros. & Co. in England. The report does not state how the total export figures compare with those of the previous year; but it records a market rise in exports from Moulmein, due largely to the sale of Burma sleepers to India. It is gratifying to see an improvement in the trade of this ancient and interesting port, which fell upon evil days during the war.

Chapter VIII, Financial Results, cover only half a page of print. It records the highest revenue, expenditure and surplus that the Department has ever had in Burma. The figures are respectively Rs. 2,21,16,786, Rs. 90,83,094 and Rs. 1,30,33,692. The first of these figures will doubtless make the mouths of other Provinces water, and with reason: the other two are not so satisfactory. The percentage of surplus to gross revenue is 59, higher than it should be; and there can be no doubt that expenditure on the improvement of the forest estate is not adequate to the situation. We hasten to say that this is not due to the shortcomings of the officers of the Department, but to the exigencies of the Budget.

The figures for 1920-21 being for nine months only, comparison with them is profitless; but we learn from the report that the increase in revenue is due almost entirely to the extraction of a larger quantity of teak and to an exceptionally good floating season. This is disappointing, for we could have hoped to see an appreciable rise in the revenue from other species. The development of the trade in these species is one of Burma's greatest needs at present; and as has been pointed out elsewhere it depends very largely on the construction of cart roads; and so we come back to the inadequate A expenditure, only 52 lakhs out of the total of 91, and 39 lakhs out of that under "exploitation." No wonder that irreverent outsiders have been heard to talk of "timber mining."

Something seems to have gone wrong with the figures in para. 146. The figure of Rs. 22,88,966 given as the cash surplus is not recognisable. Presumably an initial "1" has been omitted.

Chapter IX, Miscellaneous, has some interesting remarks on the subject of forest villages. This is a matter of the greatest importance, for regeneration cannot possibly be undertaken on

the necessary scale without a much larger labour force than is at present available. Mr. Blanford has further pointed out that not only are villages of *taungya* cutters required for regeneration work, but permanent villages for tending established crops and doing forest work generally. It is good to see that the Department is making slow but steady progress in the formation of villages, and that the evil of over-hasty action is realised. Success depends more than anything else on the Divisionnl Officer being in close touch with his villagers, and on the subordinates being of a suitable type. The latter condition is more difficult of attainment than the former.

Elephants, that is baggage elephants, are another sore point in Burma. There are never enough of them; and with the increasing staff of gazetted officers still more will be wanted. In spite of the numerous catches made in kheddahs the report does not seem very hopeful of the required number being obtainable. Is it possible that the Department will be obliged to consider seriously the proposal made not long agc by one of its junior members that African elephants should be imported?

A word of praise is due to excellent illustrations. The only complaint we can make is that there are not more of them.

W. M.

DEPARTMENT OF INDUSTRIES, BIHAR AND ORISSA.

BULLETIN No. 5.

REPORT ON A PROJECT FOR MANUFACTURING PAPER PULP AT CUTTACK, BY WILLIAM RAITT, I.F.S., M.I. CHEM. E., OFFICER IN CHARGE.

Paper Pulp Section, Forest Research Institute, Dehra Dun.

Mr. J. W. Nicholson, I.F.S., collected information and made a detailed survey of the bamboo resources of the Angul Division and of the neighbouring states, to ascertain whether sufficient supplies would be available to feed a paper pulp factory if one were established at Cuttack. The results of his investigations were embodied, in a report called "Report of the bamboo forests of the lower Mahanadi basin," published in 1922.

The above report was reviewed in the *Indian Forester* of November 1922.

Mr. Raitt has now drawn up a "Report on the project for manufacturing paper pulp at Cuttack" based on the information collected in Mr. Nicholson's report.

Mr. Raitt's report is the first example of the latest development of the activities of the paper pulp section, Forest Research Institute, Dehra Dun.

Hitherto the publications of this section have been dealt with the paper pulp industry in its broad and general application, Now, on the initiation of Local Governments, specific projects suggested by them, are being dealt with.

The report now issued deals with the manufacturing side of the question and the correlation of the forests to the manufacturing facilities available.

It is intended to follow this up with a supplement giving the actual results obtained from Angul bamboo, in the manufacturing plant, at the Forest Research Institute, Dehra Dun.

The author has selected the following extracts from his report, as being the most important and interesting :—

Introductory.

This proposition contemplates the manufacture at Cuttack of Paper Pulp from bamboo grown in the Forest Division of Angul and neighbouring states and floated down the Mahanadi river to the factory side. There exists an important limitation to its scope which it will be well to deal with at once in order to confine this report to the field of opportunity which appears to be open to it. Owing to its distance from a seaport (Calcutta or Vizagapatam) it is not an exporting proposition. Elsewhere in Burma and India locations are known where such factories would be situated on tidal water in close touch with ocean-going steamers direct from factory wharf or with only a short distance of lighterage. Such establishments will be exceptionally well placed for the foreign export of their product and, with them, an inland factory handicapped by considerable rail freight in order to reach the sea could not compete. On the other hand, for the supply of the domestic or local market, Cuttack, appears to be exceptionally

well situated as may be realised from a study of the following circumstances :—

(*a*) Calcutta (with outliers at Raniganj and Lucknow) is the centre of the Indian Paper-making industry, producing about 30,000 tons per annum and importing, 10,000 to 12,000 tons of European wood pulp annually. Such an import, which is yearly increasing provides the opening for a local supply. The market exists. Further the imports of papers are considerably greater than the local production and there is room for a large expansion of the latter provided a new supply of raw material can be found. The local raw materials now in use are already fully exploited, will not provide for any further expansion, and do not even provide for the present output.

(*b*) Areas offering a sufficiently large supply of bamboo and with water transport from forests to pulp factory within a reasonable distance of Calcutta are remarkably few in number. Angul is one of the most favourably situated. Cuttack is 254 miles from Calcutta by rail.

(*c*) Rail freight from pulp factory to paper-mill direct with no intermediate transhipment and handling charges is quite able in this case to hold its own against imports by sea with landing, transhipment and lighterage charges added to sea freight, plus a considerable additional rail charge in the cases of Raniganj and Lucknow.

(*d*) Direct rail communication between pulp factory and paper-mill offers great advantages to both parties. Large stocks need not be carried and finance is therefore simplified. Instead of dealing in shiploads at long intervals, traffic in wagon loads can proceed easily and simply from day to day.

Everything points to the destiny of Angul being that of a feeder of local paper-mills and it is as such that it will be dealt

with in this report. The most economical size unit of a pulp mill is one yielding a production of about 10,000 tons dry pulp per annum. It is governed by the capacity of the drying machine, the most costly item of outfit. A dryer for 5,000 tons costs almost as much to run as one of double the capacity and the expensive technical staff required for the lesser quantity can quite easily turn out the larger so the ton cost of the former is considerably more than the latter. We shall therefore deal with this project as if it is intended for the establishment of the most economical manufacturing unit but will also give the figures for 5,000 tons as also for 5,000 tons of dry weight in the form known as 50 *per cent. moist*. The reasons for and against the latter proposition will be discussed in Section V.

Fuel and Power.

The development of the Talcher coalfield, 65 miles from Cuttack, has an important bearing upon this project. It is doubtful, indeed, if it would be a practical proposition without it, for freight on coal from the older fields would seriously handicap it and wood fuel is not available in sufficient quantity or a low enough cost. A railway is in course of construction to connect Talcher with the main line and the cost of the coal delivered at Cuttack at present pit-head values will be about Rs. 15 per ton. In wood-pulp manufacture the coal consumption is from 15 cwt. to one ton of English coal per ton of dry pulp but allowance must be made for the lower calorific value of Indian coal. We think the consumption will be well covered by putting it a 1½ tons per ton of dry pulp, and the cost per ton of pulp will be Rs. 22-8. For *moist pulp* it will be one ton of coal per ton of pulp costing Rs. 15.

The Factory.

The writer spent several days during December 1921 and February 1923 in examining the facilities offered by Cuttack and its neighbourhood for a factory site. The essential requirements are that the spot selected should have an abundant supply of fresh water and be a common centre to which economical transport can bring the raw and subsidiary materials and from which

the manufactured product can be cheaply and expeditiously removed to its markets. The total quantity of goods to be handled per dry ton of product is 6 tons so that the transport factor is only second in importance to the raw material supply. Cuttack offers a combination of river and rail somewhat rare in our experience and it can also provide the manufacturing water and most of the labour required. The river is an excellent one for rafting, and the anicut which holds up its level for the service of the Orissa system of canals ensures a plentiful supply of water all the year round. The railway communicates with pulp markets and lime supplies and will presently provide a comparatively short connection to the Talcher Coalfield and there is also a water transport route to Calcutta by canal to Chandbally and thence by steamer to the Hooghly river.

The reduction of bamboo to pulp is intended to be effected by the reliable and well proved soda system of digestion which has been in use for many years for the treatment of grasses with certain modifications of method to adapt it to bamboo which have been worked out at the Forest Research Institute. These have resulted in a reduction of soda consumption and a marked improvement in the bleaching capacity considerably beyond what was deemed possible ten years ago. Less drastic conditions of steam pressure give an increase in pulp yield and there is the important effect on soda recovery. This system has the lowest capital cost of any.

Production, Costs and Profits.

The whole of the Capital and Production estimates are brought together in the following table :—

	5,000 tons dry weight in moist form.	5,000 tons dry.	10,000 tons dry.
1	2	3	4
CAPITAL COST.	Rs.	Rs.	Rs.
Pulp making plant, paragraph 13	3,75 0 0	5,40,000	7,60,0 0
Soda recovery ,, ,, 14	1,00,000	1,00,000	1,50,000
Steam and Power ,, ,, 15	2,55,000	2,90,000	3,25,000
Freight and erection ,, 16	2,20,000	2,90,000	3,60,000
Buildings, etc. ,, 17	4,50,000	4,80,000	5,05,000
Total ...	14,00,000	17,00,000	21,00,000
Working Capital, paragraph 19 ...	3,00,000	3,00,000	5,00,000
Total Capitalisation ,, 19 ...	17,00,000	20,00,000	26,00,000
PRODUCTION COST PER TON— Bamboo paragraph 5	30 0 0	30 0 0	32 8 0
Coal ,, 6	15 0 0	22 8 0	22 8 0
Chemicals ,, 8	36 0 0	36 0 0	36 0 0
Labour and Superintendence. ,, 20	20 0 0	20 0 0	12 0 0
Running repairs ,, 20	4 8 0	5 0 0	5 0 0
Sundries ,, 20	8 8 0	10 0 0	9 0 0
Depreciation ,, 18	17 10 0	21 14 0	13 13 0
Add 10 per cent on above say. ,, 20	13 6 0	14 10 0	13 3 0
Cost f. o. r. Cuttack ,, 21	145 0 0	160 0 0	144 0 0
Freight to Calcutta mills. ,, 21	28 0 0	19 0 0	19 0 0
Cost delivered do. ...	173 0 0	179 0 0	163 0 0
PRODUCTION COST PER TON— Value of product delivered to Calcutta mills.	250 0 0	250 0 0	250 0 0
Gross profit per ton	77 0 0	71 0 0	87 0 0
Do. percentage on capital ...	23·2%	17·8%	33·5%

Summary and Conclusions.

The correlation of forests, river, manufacturing site rail, fuel and markets is one of the best we have met with and can be unhesitatingly recommended and we know of nothing better for the supply of the local paper-mills. Although estimates have been limited to a production of 10,000 tons, 20,000 is easily possible, the minor difficulty of forest labour being surmounted by progressive effort beginning with 5,000 tons (= 12,500 tons bamboo). The estimates presented are conservative and believed to be capable of reduction and in the case of the 10,000 tons dry production result in a calculated gross profit of 33·5 per cent. on a total capital of 26 lakhs, of which 21 lakhs is Block expenditure, and based on what is regarded as a low valuation of the product. An output of 10,000 tons per annum fills but a small hole in the available market. The existing paper-mills produce about 30,000 tons of paper yearly of which only about half is made from a genuine raw material, bhabar grass, the economic collection radius of which has long since been reached. The other half is chiefly produced from imported Scandinavian wood-pulp and partly from textile washes, rags and contents of the wastepaper basket, and the bulk of the results from the three latter sources the good paper-maker regards as rubbish and would gladly discard if he could. It is these present limitations upon supplies which has prevented the expansion of paper-making in India during the last 15 years in spite of the continually expanding market which is evidenced by the paper imports. The paper-maker can do nothing more to satisfy the needs of the country until he is assured of a new local supply of material and there is none better than bamboo provided it can be given to him at an economic figure by eliminating its waste *in situ* in or near its growing area.

The economic position of bamboo as compared with wood is a very strong one. Only a few species of coniferæ are suitable and the supply of these for pulping purposes has become scarce and dear owing partly to the exhaustion of the more easily exploitable areas but mainly by the competition of the sawmill Both in volume and cost it now violates the fundamental axiom of paper-making, *viz.*, that the industry is based on waste in the

sense that its raw material must have no value for any other purpose. Bamboo is such a waste, pulp-wood no longer is. The cost of the latter is now in but rare cases less than £7 per ton of pulp and in many instances is as high as £9. The corresponding figure for bamboo as shown in the foregoing estimates is from £2 to £2·3·4. It is this difference of £5 to £7 which confers on bamboo an unassailable advantage over wood. It is equal to a 33 per cent. reduction in total cost of production. And against the present local staple, *bhabar* grass (*Ischœmum angustifolium*), bamboo has still larger advantages, the present cost of the former being about Rs. 145 per ton of unbleached pulp—a cost largely due to the demand having outrun the supply. *Bhabar* is one of the best raw materials in the world and possesses qualities which will always give it a place but, with bamboo available, paper-makers can look forward to a reduction of this high cost by resigning their more distant supply areas.

THE INDIAN FORESTS.

BY

SIR SAINTHILL EARDLEY-WILMOT, K.C.I.E.

The Report of the Indian Retrenchment Committee on Forests has been awaited with much interest by foresters throughout the world for the reason that the area involved is enormous, being no less than 23 per cent. of British India, and that the effect of its management on the national welfare is so important. It is now some seventy years since the Government of India awoke to its responsibilities in regard to the forest capital—land and crops —which without purchase had come into its possession. Gradually it became aware of the fact that, unless protected from wasteful use, no natural product, least of all a forest, is inexhaustible, and it is due to the sustained endeavours of the Indian Forest Department that official indifference and national opposition have been converted into enthusiasm on the one part and helpful acquiescence on the other. That very interesting work, *The Forests of India*, by Professor Stebbing of Edinburgh University, gives a detailed account of the struggle for the preservation of the Indian

forests, and has a circulation throughout the Indian Empire and beyond. In order to understand the magnitude of the subject with which the Retrenchment Committee had to deal, the following statistics, taken from the Annual Return of Indian Forest Administration for the financial year 1921-22, merit careful consideration recalling that when conservancy commenced, excepting in some areas inaccessible to the timber merchant of olden days, the forests had been more or less ruined by reason of unregulated commercial enterprise; the capital, as represented in timber, upon which the yearly increment or interest depended, had been seriously depleted, and the quality of the soil, by exposure to tropical and other influences, had much depreciated. Where other countries base their forestry statistics on acreage the Indian forester reckons in square miles, and a comparison of the present yield of the Indian forests by area with that of European countries to him is merely a proof of what may be attained in the future by careful scientific management. The area of the Indian State forests at the end of the period above quoted was 250,473 square miles, and the length of demarcated boundary 151,192 miles; 88,511 square miles had been surveyed in detail. The working of 59,584 square miles was controlled by sanctioned working plans; 45,779 square miles were under protection from fire; and, to mention a matter of experimental research, some 170,000 acres of plantation were in being.

Turning now to the income received from, and expenditure incurred in, this vast estate, we find that the gross income in that year amounted to £3,608,566, and the expenditure to £2,427,993, leaving a sum of £1,180,573, which was paid into the Treasury as revenue. The value of produce given free or at reduced rates to the population amounted besides to £585,786. For the five years ending 1873-74, when the organisation of the Department was in its earliest stages, the average corresponding figures were—income, £375,337; expenditure, £262,229; and surplus, £113,108.

It is hoped these statistics will give some idea of the national importance of the Indian forests, of the progress made, and of future possibilities under reasonable management, and we can now turn to the recommendations of the Retrenchment Committee. These, though summarised in two pages, are somewhat

difficult of comprehension. The statements given have reference merely to some minor areas under the direct control of the Government of India, but the provincial forests, which are of outstanding national importance, are not statistically mentioned. It is not known whether the scathing remarks regarding the impossibility of obtaining trustworthy information as to the working or financial results of forest operations are intended to apply only to the small area under the direct control of the Head-quarters Government of India, but as the whole of the provincia forests were, until quite recently, similarly controlled, they cannot escape this adverse criticism. Moreover, as the Administration Report from which the foregoing statistics are quoted includes full details of both areas, it was not 'obviously' impossible for the Committee to have gained some information to aid them in their decisions. The Committee acknowledge that management and development on technical lines is reputed to have been successful but consider that a radical change should be made to management on commercial lines, giving as a reason the excess of timber imports over exports. The control of the forests should be vested, they say, in a manager with commercial experience in the timber industry, assisted by technical experts, and at the same time expenditure in research should be reduced and some indefinite portion of it left to private enterprise.

The question of the commercial management of forests is as old as the forests themselves. It is to the commercial management of the past that the depletion of the forests of the world is due. It is in India and elsewhere that the forester is attempting to restore the exhausted capital, so that in the future a high rate of yearly interest may be obtained for the State, and provision made for the needs of the populace as well as for any unforeseen emergency.

In no industry is it easier to pay revenue out of capital without detection than in forestry, while the chief work of the forester is to improve the capital in land and crop so that the yield will be both high and constant. Examples of the effect of uncontrolled commercialism are everywhere apparent in Europe, in America, and in India, so that it is a commonplace remark that it takes 100

years to repair the injury which may be done by unrestricted commercialism in less than one-third of that time. The restoration of the capital value of the Indian forests has been well begun by the Forest Department, but is still in its infancy. It has persistently been hampered by the financial policy of the Government of India, who delayed development by classifying the forests as a Revenue Department and by taking from it for over fifty years, from one-third to one-half of its gross income, which should have been spent in the organisation of a direct property. Had this been done the forest capital would by now have yielded not three but six or nine, million pounds yearly, with a prospect of increasing values. A forest loan at a high rate of interest, as recommended by one far-seeing Government official, would have saved the situation. For instance, in forestry good communications are vital to financial success, and those Provinces which have attracted railway construction by Working Plans prescribing the out-turn over a term of years are those which show the best results both financially and in the welfare of the population. Transport facilities in roads, bridges, tramways, etc., are expensive, but rapidly repay the outlay by creating distant markets, and without them forests are of little value.

At the same time, it must not be forgotten that the first duty of the forests of India is to supply its 300 million inhabitants with timber for agricultural and domestic purposes and with fuel. If the forests were fully stocked there would be no difficulty in meeting this demand, but in their present condition the commercial timber agent will find little to export save teak and various fancy woods, which have already a good market because the indigenous population cannot afford to utilise them. When the Indian Public Works and Railways are forced to import timber it is evident that at their price, including delivery be it remembered, there is no surplus in India, nor will there be for many years, until the forests become—if allowed to—in fuller bearing. The commercial timber agent can usefully occupy his time in preparation for this period by the construction of transport facilities, if he can get the money from the Legislative Councils, for even a full forest crop without cheap means of distribution will not prove to be a financial success.

It is a curious idiosyncrasy of the majority of the inhabitants of these islands that their thoughts on forests seldom proceed beyond timber. But elsewhere the importance of so-called Minor Forest Produce looms large, and especially is this the case in India. For instance, in the year 1921-22 the value of lac at port of shipment was, in comparison with the total gross revenue of the forests of India, as 76 to 54. Lac is essentially a forest product. There are other products, such as cutch, myrobalans, cardamoms, and a host of other material, such as bamboo, which only require systematic development Their qualities we know, thanks to the splendid work carried out for India at the Imperial Institute which, sad to say, owing to Governmental supineness, has benefited chiefly the pushing alien merchant. Yearly our knowledge of Indian forest products is increasing owing to the pioneer work of the Research Institute at Dehra Dun. Pending the period when the Indian forests are in fuller bearing, and transport facilities better organised, it would pay well to concentrate more on the minor products which are more readily transported than timber and find a good market the world over.

And this brings us to research and its proposed restriction by the Retrenchment Committee. If ever there was a time when the expenditure on research was justified it is at this moment, when the Forest Department has gone, after years of spade work, some way towards the development of its timber areas, and has more leisure, if provided with knowledge, to increase the yield of no less valuable accessory products. The Indian research work at the Imperial Institute, to which we owe so much, combined with that of the local Institute at Dehra Dun, could, if properly arranged and co-ordinated, be the means of providing thousands of pounds monthly as revenue in the future, yet both these agencies for development are to be hampered if the proposals of the Retrenchment Committee are accepted.

The future of India from an industrial point of view has also to be considered. It is to be hoped that in the not distant future the forests in their vast extent will yield not only sufficient raw material for the immediate use of the population, but also manufactured articles for export, for it is in this way that the uncertain

existence of a vast agricultural population will be improved. In the forests of India some 12 million head of cattle graze, and we want no more of the exportation of hundreds of millions of raw hides to Germany to be returned as gloves and other fancy articles, no more of the exportation of raw material such as lac in millions of pounds worth to be bought again with the added salaries of foreign workmen and middlemen. We want to give the Indian craftsman, than who none is better, a chance of making a living out of the products of his own land. And we set about doing this by proposing to save a few thousand pounds by the curtailment of the scientific and technical investigation which we of the West at this time are alone in a position so to carry out that the value and treatment of the country's products may be known and profited by locally.

After thirty-six years in the forests of India, the writer has no bias against commercialism in State Forests, provided it is limited to prescribing the requirements of the market and to disposing of the legitimate yield to the best advantage, and that to the trained forester is left the duty of scientific management with a view to obtaining the highest return on the invested capital. In short, that the forest officer should be assisted by the commercial agent, and not, as proposed, that the latter should control, with the assistance of the forest officer. Should the latter arrangement materialise, there will always be a fear that the commercial agent will, at this stage in the organisation of the Indian forests, be forced to justify his existence at the cost of the timber capital of these forests, say, by the removal in excess of the overwood so necessary to soil protection, or of the immature crop which represents the future capital. For safety, in practice the commercial agent must remain subordinate to the expert forester in regard to the maintenance and improvement of the area, though the latter would gladly hand over the harvest to the former for disposal, and so obtain more freedom for his professional duties in protecting and increasing the yield. The forests of India are a valuable national asset. The proportion of wooded area and its value vary immensely in different provinces. Its management also varies with climate, species, and locality, and no one province is justified

in a selfish utilisation of its forest area, resulting in depreciation of its national value. The advantages and disadvantages of provincial devolution so far as the forests are concerned, therefore, depend on the character and exigencies of the provincial Government. It has before been pointed out that it is easy in forestry to provide revenue out of capital, and some safeguards appear to be necessary to protect national interests against encroachment. Some of these safeguards would be the sanctioning of regular working plans, from which there should be no deviation without permission; the prohibition of alienation of forest land without reference; and approval of proposed appointment of senior administrative officers. For it will be a sad day for the forests of India when the Headquarters of the Government of India renounces all authority over the forest lands which it holds in trust for the good of the people of India as a whole, and over the forest crops which its officers have developed during the past years of strenuous labour. Finally, as to the nationalisation of the Indian Forest Department, the forest officer recognises no distinction of race or colour, and perhaps in no profession is the community of interests more binding or intercourse more helpful. His happiest memories are often of success with untutored savages in the jungle, or of Indians who have shown loyalty and devotion in danger and difficulty.

But the Indian Forest Department has, like other services, its traditions of self-abnegation in exploration, of devotion to duty in loneliness and hardship, of relaxation in sport or science, of loyalty to the forests for which it is responsible, and there is no reason to apprehend that these traditions and this *esprit de corps* will lose in vitality by appointment of Indians to carry on the work so ably inaugurated by their British *confrères*, provided they bring to the task physique and enthusiasm not inferior to that of their predecessors. The present danger is that, under cover of 'retrenchment,' irreparable damage may be done to the steady progress of forest organisation in India, which has hitherto characterised the work of what is rightly regarded as the finest and most effective Forest Service in the British Empire.

[*The Nineteenth Century*, *September 1923*.]

CORRESPONDENCE.

LATE ANNUAL REPORTS.

SIR,—In the October number of the *Indian Forester* there is a review of an annual report for 1921-22 which *finished* 18 months ago, which, I understand, reached your office in the third week of March 1923. I received the research report for the same year in my office 14 months after its close.

Yesterday I received from New Zealand their printed annual report for the year ending March 31st, 1923, that is, within 6 months of the close of the year.

Comment is needless.

S. H. HOWARD, I.F.S.